**SEVENTIETH CONFERENCE OF THE**
**SIXTH JUDICIAL CIRCUIT OF THE UNITED STATES**

**Columbus, Ohio**
**May 6, 2010**

# Objectivity on Trial: Revisiting Old Convictions in Light of New Technology

I. Introduction

II. Post-conviction DNA testing and the Ohio Innocence Project –
Mark Godsey, Professor of Law, University of Cincinnati College of Law/Ohio Innocence Project

The recent National Academy of Sciences (NAS) report that outlined serious problems with the state of forensic science in this country was brought about, in large part, by the advent of post-conviction DNA testing in the early 1990s, which exposed systematic flaws in our criminal justice system. DNA testing gave rise to Innocence Projects and the Innocence Movement, which, by exposing the problem of wrongful conviction, has offered us a great learning moment and an unprecedented opportunity to vastly improve the system.

Professor Godsey will discuss the evolution and history of DNA and the innocence movement, and set the stage for panelist that follow who will address some of the problems the movement has exposed regarding forensic sciences.

A. How the innocence movement began and evolved.
B. Current statistics regarding the number of documented wrongful convictions in the U.S.
C. How many innocent people are wrongfully convicted? Exploring the magnitude of the problem.
D. The evolving nature of DNA technologies.
E. Wrongful convictions have been exposed mostly at the state level. Understanding the differences between the state and federal prosecutions, and how lessons learned from the innocence movement apply to the federal system.
F. The cracks in the system exposed by DNA and the innocence movement.
G. The needed reforms: Ohio's Senate Bill 77.

III. The National Academy of Sciences (NAS) Report –

Jay A. Siegel, Ph.D., Chair, Department of Chemistry and Chemical Biology, Director: Forensic and Investigative Sciences Program, Indiana University Purdue University Indianapolis

The National Academy of Sciences Committee on Forensic Science released its report on February 18, 2009, entitled: *Strengthening Forensic Science in the United States: A Path Forward.* The report contained 13 recommendations to improve forensic science. It included the formation of an independent oversight agency, a call for mandatory accreditation and certification, increased standardization of methods, terminology, reports and interpretation, increased support for research and education in forensic science and forensic pathology and others. Particular attention was paid to so-called pattern evidence, which includes fingerprints, firearms and tool marks, handwriting, footwear and tire treads, and hair analysis. Issues included a lack of scientific foundation for assertions of individuality, lack of validation of methods and conclusions and lack of scientific standards including error rates. Several recommendations attempt to address these shortcomings in pattern evidence.

IV. Scientific Evidence in the Field: Expectations and Realities –

Anjali R. Swienton, M.F.S., J.D., President & CEO SciLawForensics, Ltd.

Public perception of what the forensic laboratory can and cannot do has been skewed by popular television programs such as CSI. Although forensic science is an invaluable law enforcement tool, caution must be exercised when evaluating and interpreting the evidence. Evolving newer technologies can shed light on earlier conclusions that, although not incorrect at the time, may prove to have been misleading due to the limitations of the earlier disciplines and ways in which testimony was given. The amount of foundational science for a specific forensic discipline should relate to the degree of certainty that can be attached to its conclusions, yet this is not always the case. It is the scientist's responsibility to clarify for the court the boundaries for each technology. Where sufficient underlying research is still lacking, it may fall to the courts to require science to fill the gaps so that only the most reliable evidence is brought forward.

V. Pattern Evidence: A New Look at an Old Concept –

Jennifer Mnookin, J.D., Professor of Law, UCLA School of Law.

UCLA School of Law professor Jennifer Mnookin will discuss her present project that will establish a scientific method to quantify the accuracy and error rates of latent fingerprint examination, one of the most widely used

forensic disciplines. The study is being funded by a $866,764 grant from the National Institute of Justice, which has dedicated funds in response to the recent NAS report on the state of forensic science. The project will have four phases. In phase 1, a fingerprint database will be created; in phase 2, methods to quantify the visual complexity of fingerprints and comparisons will be examined and developed; in phase 3, a cognitive-difficulty analysis will be combined with a visual-complexity analysis to establish and test a difficulty classification scheme for fingerprint comparisons; and in ph ase 4, the potential for error for each difficulty classification level in the hierarchy will be determined.

VI. Attachments

A. National Academy of Sciences (NAS) report on forensic science, executive summary. (Complete report available at http://www.nap.edu/catalog.php?record_id=12589).

B. PowerPoint presentation slides by Anjali R. Swienton, M.F.S., J.D.

C. PowerPoint presentation slides by Professor Jennifer Mnookin, J.D.

VII. Biographies

**Mark Godsey** is a professor of law at the University of Cincinnati College of Law, and the Director and Co-Founder of the Ohio Innocence Project. He is an award-winning teacher and an internationally-recognized scholar, attorney and leader in the field of wrongful convictions. On this subject, he has published in some of the nation's most prestigious law reviews, appeared regularly in the national press and television programs, and been an invited speaker around the U.S. and in numerous countries. A graduate of Northwestern University and The Ohio State University College of Law, he clerked for a federal appeals court judge, worked as an associate in a large corporate law firm, and then served as an Assistant United States Attorney for the Southern District of New York before entering academia in 2001.

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**Jay Siegel** holds a Ph.D. in Analytical Chemistry from George Washington University. He worked for three years at the Virginia Bureau of Forensic Sciences, analyzing drugs, fire residues and trace evidence. He was then professor of chemistry and forensic science at Metropolitan State College for three years. From 1980 to 2004 he was professor of forensic chemistry and Director of the forensic science program at Michigan State University in the School of Criminal Justice. In 2004 he moved to Indiana University, Purdue University, Indianapolis to become Director of the Forensic and Investigative Sciences Program. In 2008 he also became Chair of the Department of Chemistry and Chemical Biology at IUPUI.

Dr. Siegel has testified over 200 times as an expert witness in seven states, Federal Court and Military Court. He is Editor in Chief of the Encyclopedia of Forensic Sciences and has over 20 publications in forensic science journals. He has published a college text book entitled "Fundamentals of Forensic Science" for Elsevier and a high school forensic science textbook; "Forensic Science: The Basics" published by CRC. Both are going into 2nd editions. His newest book, "Forensic Science: A Beginner's Guide," came out in May. In February 2009, he was named Distinguished Fellow by the American Academy of Forensic Sciences. In April 2009, he was given the Distinguished Alumni Scholar Award by his alma mater, George Washington University.

Jay A. Siegel, Ph.D.
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**Anjali R. Swienton** is the President SciLawForensics, Ltd., a forensic science and legal consulting firm in Germantown, MD and the Director of Outreach for the National Clearinghouse for Science, Technology and Law at Stetson University College of Law. Ms. Swienton is an Advisory Commissioner on the AAFS's Forensic Science Education Programs Accreditation Commission (FEPAC) and has served on the AAFS program committee in various capacities for the last six years including the 2009-2010 Criminalistics Section Chair and the 2009 and 2010 program Plenary Session Co-Chair. She conducts training of law enforcement, attorneys, judges, forensic scientists and other experts in various aspects of forensic science and law and consults on criminal cases involving complex scientific evidence. Ms. Swienton previously worked as a contractor to the National Institute of Justice's (NIJ) Investigative and Forensic Sciences Division where she served as a subject matter expert on Attorney General Reno's National Commission on the Future of DNA Evidence, a coordinator for NIJ's five annual Conferences on DNA and Science and the Law, and the facilitator of several technical working groups (TWGs) on various forensic issues. Prior to NIJ, Ms. Swienton worked as a staff DNA analyst at Cellmark Diagnostics where she conducted forensic DNA testing and provided expert testimony across the country. She holds a B.A. degree in Molecular Biology from The Johns Hopkins University, an M.F.S. degree in Forensic Science from The George Washington University, and a J.D. degree from the American University, Washington College of Law.

**Jennifer Mnookin** is Professor of Law at the UCLA School of Law. From 2007-2009, she served as Vice Dean for Faculty and Research. She joined the UCLA faculty in 2005; her previous academic appointments include Professor of Law and Barron F. Black Research Professor at the University of Virginia School of Law, and Visiting Professor of Law at the Harvard Law School. She regularly teaches Evidence and Torts, as well as seminars in topics relating to expert evidence and law and popular culture.

Professor Mnookin researches and writes primarily in the area of Evidence, particularly expert and scientific evidence, and the use of forensic science in court. She has published numerous academic articles on a variety of evidence-related subjects, including, among others, *Daubert* and the appropriate standards for expert evidence; forms of forensic science including latent fingerprint examination and handwriting identification; DNA profiling; expert evidence and the Confrontation Clause; documentary films and legal evidence; and the history of expert evidence. Her most recent publications include, "Of Black Boxes, Instruments, and Experts: Testing the Validity of Forensic Science," 5 Episteme 343 (2008); "Expert Evidence, Partisanship, and Epistemic Competence," 73 Brooklyn L. Rev. 1009 (2008) (symposium issue); and "The Validity of Latent Fingerprint Identification: Confessions of a Fingerprinting Moderate," 7 J. Law, Prob. & Risk 127 (2008). She is also a co-author of The New Wigmore's Expert Evidence volume (with David Kaye and David Bernstein) (Aspen Publishers, 2004, with annual supplements).

Professor Mnookin is on the board of several academic journals, and is currently a member of the NIJ/NIST Expert Working Group on Human Factors in Fingerprinting. She has served as a member of the National Academy of Science's Committee on Daubert Standards and as Chair of the Evidence Section of the American Association of Law Schools. Mnookin received her A.B. from Harvard College; her J.D. from Yale Law School, and her Ph.D. in the History and Sociology of Science from the Massachusetts Institute of Technology.

VIII. Suggested readings:

Samuel Gross, Exonerations in the United States, 1989 to 2003, JOURNAL OF CRIMINAL LAW AND CRIMINOLOGY, Vol. 95, No. 2. 2005.

Brandon Garrett, Innocence, Harmless Error, and Federal Wrongful Conviction Law, WISCONSIN LAW REVIEW, Vol. 35, 2005.

Brandon Garrett, Judging Innocence, COLUMBIA LAW REVIEW, January 2008.

Brandon Garrett and Peter Neufeld, Invalid Forensic Science Testimony and Wrongful Convictions, VIRGINIA LAW REVIEW, Vol. 95, No. 1, 2009.

# Attachment A

# National Academy of Sciences (NAS) report on forensic science, executive summary

# STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES

## A PATH FORWARD

Committee on Identifying the Needs of the Forensic Science Community

Committee on Science, Technology, and Law
Policy and Global Affairs

Committee on Applied and Theoretical Statistics
Division on Engineering and Physical Sciences

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The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. Charles M. Vest are chair and vice chair, respectively, of the National Research Council.

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# Summary

## INTRODUCTION

On November 22, 2005, the Science, State, Justice, Commerce, and Related Agencies Appropriations Act of 2006 became law.[1] Under the terms of the statute, Congress authorized "the National Academy of Sciences to conduct a study on forensic science, as described in the Senate report."[2] The Senate Report to which the Conference Report refers states:

> While a great deal of analysis exists of the requirements in the discipline of DNA, there exists little to no analysis of the remaining needs of the community outside of the area of DNA. Therefore . . . the Committee directs the Attorney General to provide [funds] to the National Academy of Sciences to create an independent Forensic Science Committee. This Committee shall include members of the forensics community representing operational crime laboratories, medical examiners, and coroners; legal experts; and other scientists as determined appropriate.[3]

The Senate Report also sets forth the charge to the Forensic Science Committee, instructing it to:

(1) assess the present and future resource needs of the forensic science community, to include State and local crime labs, medical examiners, and coroners;

[1] P.L. No. 109-108, 119 Stat. 2290 (2005).
[2] H.R. Rep. No. 109-272, at 121 (2005) (Conf. Rep.).
[3] S. Rep. No. 109-88, at 46 (2005).

(2) make recommendations for maximizing the use of forensic technologies and techniques to solve crimes, investigate deaths, and protect the public;
(3) identify potential scientific advances that may assist law enforcement in using forensic technologies and techniques to protect the public;
(4) make recommendations for programs that will increase the number of qualified forensic scientists and medical examiners available to work in public crime laboratories;
(5) disseminate best practices and guidelines concerning the collection and analysis of forensic evidence to help ensure quality and consistency in the use of forensic technologies and techniques to solve crimes, investigate deaths, and protect the public;
(6) examine the role of the forensic community in the homeland security mission;
(7) [examine] interoperability of Automated Fingerprint Information Systems [AFIS]; and
(8) examine additional issues pertaining to forensic science as determined by the Committee.[4]

In the fall of 2006, a committee was established by the National Academy of Sciences to implement this congressional charge. As recommended in the Senate Report, the persons selected to serve included members of the forensic science community, members of the legal community, and a diverse group of scientists. Operating under the project title "Identifying the Needs of the Forensic Science Community," the committee met on eight occasions: January 25-26, April 23-24, June 5-6, September 20-21, and December 6-7, 2007, and March 24-25, June 23-24, and November 14-15, 2008. During these meetings, the committee heard expert testimony and deliberated over the information it heard and received. Between meetings, committee members reviewed numerous published materials, studies, and reports related to the forensic science disciplines, engaged in independent research on the subject, and worked on drafts of the final report.

Experts who provided testimony included federal agency officials; academics and research scholars; private consultants; federal, state, and local law enforcement officials; scientists; medical examiners; a coroner; crime laboratory officials from the public and private sectors; independent investigators; defense attorneys; forensic science practitioners; and leadership of professional and standard setting organizations (see the Acknowledgments and Appendix B for a complete listing of presenters).

[4] Ibid.

The issues covered during the committee's hearings and deliberations included:

(a) the fundamentals of the scientific method as applied to forensic practice—hypothesis generation and testing, falsifiability and replication, and peer review of scientific publications;
(b) the assessment of forensic methods and technologies—the collection and analysis of forensic data; accuracy and error rates of forensic analyses; sources of potential bias and human error in interpretation by forensic experts; and proficiency testing of forensic experts;
(c) infrastructure and needs for basic research and technology assessment in forensic science;
(d) current training and education in forensic science;
(e) the structure and operation of forensic science laboratories;
(f) the structure and operation of the coroner and medical examiner systems;
(g) budget, future needs, and priorities of the forensic science community and the coroner and medical examiner systems;
(h) the accreditation, certification, and licensing of forensic science operations, medical death investigation systems, and scientists;
(i) Scientific Working Groups (SWGs) and their practices;
(j) forensic science practices—
pattern/experience evidence
- fingerprints (including the interoperability of AFIS)
- firearms examination
- toolmarks
- bite marks
- impressions (tires, footwear)
- bloodstain pattern analysis
- handwriting
- hair

analytical evidence
- DNA
- coatings (e.g., paint)
- chemicals (including drugs)
- materials (including fibers)
- fluids
- serology
- fire and explosive analysis

digital evidence;
(k) the effectiveness of coroner systems as compared with medical examiner systems;

(l ) the use of forensic evidence in criminal and civil litigation—
- o the collection and flow of evidence from crime scenes to courtrooms
- o the manner in which forensic practitioners testify in court
- o cases involving the misinterpretation of forensic evidence
- o the adversarial system in criminal and civil litigation
- o lawyers' use and misuse of forensic evidence
- o judges' handling of forensic evidence;

(m) forensic practice and projects at various federal agencies, including NIST, the FBI, DHS, U.S. Secret Service, NIJ, DEA, and DOD;
(n) forensic practice in state and local agencies;
(o) nontraditional forensic service providers; and
(p) the forensic science community in the United Kingdom.

The testimonial and documentary evidence considered by the committee was detailed, complex, and sometimes controversial. Given this reality, the committee could not possibly answer every question that it confronted, nor could it devise specific solutions for every problem that it identified. Rather, it reached a consensus on the most important issues now facing the forensic science community and medical examiner system and agreed on 13 specific recommendations to address these issues.

### Challenges Facing the Forensic Science Community

For decades, the forensic science disciplines have produced valuable evidence that has contributed to the successful prosecution and conviction of criminals as well as to the exoneration of innocent people. Over the last two decades, advances in some forensic science disciplines, especially the use of DNA technology, have demonstrated that some areas of forensic science have great additional potential to help law enforcement identify criminals. Many crimes that may have gone unsolved are now being solved because forensic science is helping to identify the perpetrators.

Those advances, however, also have revealed that, in some cases, substantive information and testimony based on faulty forensic science analyses may have contributed to wrongful convictions of innocent people. This fact has demonstrated the potential danger of giving undue weight to evidence and testimony derived from imperfect testing and analysis. Moreover, imprecise or exaggerated expert testimony has sometimes contributed to the admission of erroneous or misleading evidence.

Further advances in the forensic science disciplines will serve three important purposes. First, further improvements will assist law enforcement officials in the course of their investigations to identify perpetrators with higher reliability. Second, further improvements in forensic science practices

should reduce the occurrence of wrongful convictions, which reduces the risk that true offenders continue to commit crimes while innocent persons inappropriately serve time. Third, any improvements in the forensic science disciplines will undoubtedly enhance the Nation's ability to address the needs of homeland security.

Numerous professionals in the forensic science community and the medical examiner system have worked for years to achieve excellence in their fields, aiming to follow high ethical norms, develop sound professional standards, ensure accurate results in their practices, and improve the processes by which accuracy is determined. Although the work of these dedicated professionals has resulted in significant progress in the forensic science disciplines in recent decades, major challenges still face the forensic science community. It is therefore unsurprising that Congress instructed this committee to, among other things, "assess the present and future resource needs of the forensic science community," "make recommendations for maximizing the use of forensic technologies and techniques," "make recommendations for programs that will increase the number of qualified forensic scientists and medical examiners," and "disseminate best practices and guidelines concerning the collection and analysis of forensic evidence to help ensure quality and consistency in the use of forensic technologies and techniques." These are among the pressing issues facing the forensic science community. The best professionals in the forensic science disciplines invariably are hindered in their work because these and other problems persist.

The length of the congressional charge and the complexity of the material under review made the committee's assignment challenging. In undertaking it, the committee first had to gain an understanding of the various disciplines within the forensic science community, as well as the community's history, its strengths and weaknesses, and the roles of the people and agencies that constitute the community and make use of its services. In so doing, the committee was able to better comprehend some of the major problems facing the forensic science community and the medical examiner system. A brief review of some of these problems is illuminating.[5]

## Disparities in the Forensic Science Community

There are great disparities among existing forensic science operations in federal, state, and local law enforcement jurisdictions and agencies. This is true with respect to funding, access to analytical instrumentation, the availability of skilled and well-trained personnel, certification, accreditation, and

[5] In this report, the "forensic science community," broadly speaking, is meant to include forensic pathology and medicolegal death investigation, which is sometimes referred to as "the medical examiner system" or "the medicolegal death investigation system."

oversight. As a result, it is not easy to generalize about current practices within the forensic science community. It is clear, however, that any approach to overhauling the existing system needs to address and help minimize the community's current fragmentation and inconsistent practices.

Although the vast majority of criminal law enforcement is handled by state and local jurisdictions, these entities often are sorely lacking in the resources (money, staff, training, and equipment) necessary to promote and maintain strong forensic science laboratory systems. By comparison, federal programs are often much better funded and staffed. It is also noteworthy that the resources, the extent of services, and the amount of expertise that medical examiners and forensic pathologists can provide vary widely in different jurisdictions. As a result, the depth, reliability, and overall quality of substantive information arising from the forensic examination of evidence available to the legal system vary substantially across the country.

### Lack of Mandatory Standardization, Certification, and Accreditation

The fragmentation problem is compounded because operational principles and procedures for many forensic science disciplines are not standardized or embraced, either between or within jurisdictions. There is no uniformity in the certification of forensic practitioners, or in the accreditation of crime laboratories. Indeed, most jurisdictions do not require forensic practitioners to be certified, and most forensic science disciplines have no mandatory certification programs. Moreover, accreditation of crime laboratories is not required in most jurisdictions. Often there are no standard protocols governing forensic practice in a given discipline. And, even when protocols are in place (e.g., SWG standards), they often are vague and not enforced in any meaningful way. In short, the quality of forensic practice in most disciplines varies greatly because of the absence of adequate training and continuing education, rigorous mandatory certification and accreditation programs, adherence to robust performance standards, and effective oversight.[6] These shortcomings obviously pose a continuing and serious threat to the quality and credibility of forensic science practice.

### The Broad Range of Forensic Science Disciplines

The term "forensic science" encompasses a broad range of forensic disciplines, each with its own set of technologies and practices. In other words, there is wide variability across forensic science disciplines with regard to

[6] See, e.g., P.C. Giannelli. 2007. Wrongful convictions and forensic science: The need to regulate crime labs. 86 N.C. L. Rev. 163 (2007); B. Schmitt and J. Swickard. 2008. "Detroit Police Lab Shut Down After Probe Finds Errors." *Detroit Free Press*. September 25.

techniques, methodologies, reliability, types and numbers of potential errors, research, general acceptability, and published material. Some of the forensic science disciplines are laboratory based (e.g., nuclear and mitochondrial DNA analysis, toxicology and drug analysis); others are based on expert interpretation of observed patterns (e.g., fingerprints, writing samples, toolmarks, bite marks, and specimens such as hair). The "forensic science community," in turn, consists of a host of practitioners, including scientists (some with advanced degrees) in the fields of chemistry, biochemistry, biology, and medicine; laboratory technicians; crime scene investigators; and law enforcement officers. There are very important differences, however, between forensic laboratory work and crime scene investigations. There are also sharp distinctions between forensic practitioners who have been trained in chemistry, biochemistry, biology, and medicine (and who bring these disciplines to bear in their work) and technicians who lend support to forensic science enterprises. Many of these differences are discussed in the body of this report.

The committee decided early in its work that it would not be feasible to develop a detailed evaluation of each discipline in terms of its scientific underpinning, level of development, and ability to provide evidence to address the major types of questions raised in criminal prosecutions and civil litigation. However, the committee solicited testimony on a broad range of forensic science disciplines and sought to identify issues relevant across definable classes of disciplines. As a result of listening to this testimony and reviewing related written materials, the committee found substantial evidence indicating that the level of scientific development and evaluation varies substantially among the forensic science disciplines.

### Problems Relating to the Interpretation of Forensic Evidence

Often in criminal prosecutions and civil litigation, forensic evidence is offered to support conclusions about "individualization" (sometimes referred to as "matching" a specimen to a particular individual or other source) or about classification of the source of the specimen into one of several categories. With the exception of nuclear DNA analysis, however, no forensic method has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source. In terms of scientific basis, the analytically based disciplines generally hold a notable edge over disciplines based on expert interpretation. But there are important variations among the disciplines relying on expert interpretation. For example, there are more established protocols and available research for fingerprint analysis than for the analysis of bite marks. There also are significant variations within each discipline. For example, not all fingerprint evidence is

equally good, because the true value of the evidence is determined by the quality of the latent fingerprint image. These disparities between and within the forensic science disciplines highlight a major problem in the forensic science community: The simple reality is that the interpretation of forensic evidence is not always based on scientific studies to determine its validity. This is a serious problem. Although research has been done in some disciplines, there is a notable dearth of peer-reviewed, published studies establishing the scientific bases and validity of many forensic methods.[7]

### The Need for Research to Establish Limits and Measures of Performance

In evaluating the accuracy of a forensic analysis, it is crucial to clarify the type of question the analysis is called on to address. Thus, although some techniques may be too imprecise to permit accurate identification of a specific individual, they may still provide useful and accurate information about questions of classification. For example, microscopic hair analysis may provide reliable evidence on some characteristics of the individual from which the specimen was taken, but it may not be able to reliably match the specimen with a specific individual. However, the definition of the appropriate question is only a first step in the evaluation of the performance of a forensic technique. A body of research is required to establish the limits and measures of performance and to address the impact of sources of variability and potential bias. Such research is sorely needed, but it seems to be lacking in most of the forensic disciplines that rely on subjective assessments of matching characteristics. These disciplines need to develop rigorous protocols to guide these subjective interpretations and pursue equally rigorous research and evaluation programs. The development of such research programs can benefit significantly from other areas, notably from the large body of research on the evaluation of observer performance in diagnostic medicine and from the findings of cognitive psychology on the potential for bias and error in human observers.[8]

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[7] Several articles, for example, have noted the lack of scientific validation of fingerprint identification methods. See, e.g., J.J. Koehler. Fingerprint error rates and proficiency tests: What they are and why they matter. 59 HASTINGS L.J. 1077 (2008); L. Haber and R.N. Haber. 2008. Scientific validation of fingerprint evidence under *Daubert*. *Law, Probability and Risk* 7(2):87; J.L. Mnookin. 2008. The validity of latent fingerprint identification: Confessions of a fingerprinting moderate. *Law, Probability and Risk* 7(2):127.

[8] The findings of forensic science experts are vulnerable to cognitive and contextual bias. See, e.g., I.E. Dror, D. Charlton, and A.E. Péron. 2006. Contextual information renders experts vulnerable to making erroneous identifications. *Forensic Science International* 156:74, 77. ("Our study shows that it is possible to alter identification decisions on the same fingerprint, solely by presenting it in a different context."); I.E. Dror and D. Charlton. 2006. Why experts make errors. *Journal of Forensic Identification* 56(4):600; Giannelli, *supra* note 6, pp. 220-222. Unfortunately, at least to date, there is no good evidence to indicate that the forensic

### The Admission of Forensic Science Evidence in Litigation

Forensic science experts and evidence are used routinely in the service of the criminal justice system. DNA testing may be used to determine whether sperm found on a rape victim came from an accused party; a latent fingerprint found on a gun may be used to determine whether a defendant handled the weapon; drug analysis may be used to determine whether pills found in a person's possession were illicit; and an autopsy may be used to determine the cause and manner of death of a murder victim. In order for qualified forensic science experts to testify competently about forensic evidence, they must first find the evidence in a usable state and properly preserve it. A latent fingerprint that is badly smudged when found cannot be usefully saved, analyzed, or explained. An inadequate drug sample may be insufficient to allow for proper analysis. And, DNA tests performed on a contaminated or otherwise compromised sample cannot be used reliably to identify or eliminate an individual as the perpetrator of a crime. These are important matters involving the proper processing of forensic evidence. The law's greatest dilemma in its heavy reliance on forensic evidence, however, concerns the question of whether—and to what extent—there is *science* in any given forensic science discipline.

Two very important questions should underlie the law's admission of and reliance upon forensic evidence in criminal trials: (1) the extent to which a particular forensic discipline is founded on a reliable scientific methodology that gives it the capacity to accurately analyze evidence and report findings and (2) the extent to which practitioners in a particular forensic discipline rely on human interpretation that could be tainted by error, the threat of bias, or the absence of sound operational procedures and robust performance standards. These questions are significant. Thus, it matters a great deal whether an expert is qualified to testify about forensic evidence and whether the evidence is sufficiently reliable to merit a fact finder's reliance on the truth that it purports to support. Unfortunately, these important questions do not always produce satisfactory answers in judicial decisions pertaining to the admissibility of forensic science evidence proffered in criminal trials.

In 1993, in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,[9] the Supreme Court ruled that, under Rule 702 of the Federal Rules of Evidence (which covers both civil trials and criminal prosecutions in the federal courts), a "trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable."[10] The Court indicated

science community has made a sufficient effort to address the bias issue; thus, it is impossible for the committee to fully assess the magnitude of the problem.

[9] 509 U.S. 579 (1993).

[10] Ibid., p. 589.

that the subject of an expert's testimony should be scientific knowledge, so that "evidentiary reliability will be based upon scientific validity."[11] The Court also emphasized that, in considering the admissibility of evidence, a trial judge should focus "solely" on the expert's "principles and methodology," and "not on the conclusions that they generate."[12] In sum, *Daubert*'s requirement that an expert's testimony pertain to "scientific knowledge" established a standard of "evidentiary reliability."[13]

In explaining this evidentiary standard, the *Daubert* Court pointed to several factors that might be considered by a trial judge: (1) whether a theory or technique can be (and has been) tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) the known or potential rate of error of a particular scientific technique; (4) the existence and maintenance of standards controlling the technique's operation; and (5) a scientific technique's degree of acceptance within a relevant scientific community.[14] In the end, however, the Court emphasized that the inquiry under Rule 702 is "a flexible one."[15] The Court expressed confidence in the adversarial system, noting that "[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence."[16] The Supreme Court has made it clear that trial judges have great discretion in deciding on the admissibility of evidence under Rule 702, and that appeals from *Daubert* rulings are subject to a very narrow abuse-of-discretion standard of review.[17] Most importantly, in *Kumho Tire Co., Ltd. v. Carmichael*, the Court stated that "whether *Daubert*'s specific factors are, or are not, reasonable measures of reliability in a particular case is a matter that the law grants the trial judge broad latitude to determine."[18]

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[11] Ibid., pp. 590 and 591 n.9 (emphasis omitted).

[12] Ibid., p. 595. In *General Electric Co. v. Joiner*, 522 U.S. 136, 146 (1997), the Court added: "[C]onclusions and methodology are not entirely distinct from one another. Trained experts commonly extrapolate from existing data. But nothing in *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert."

[13] *Daubert*, 509 U.S. at 589, 590 n.9, 595.

[14] Ibid., pp. 593-94.

[15] Ibid., p. 594. *In Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137 (1999), the Court confirmed that the *Daubert* factors do not constitute a definitive checklist or test. *Kumho Tire* importantly held that Rule 702 applies to both scientific and nonscientific expert testimony; the Court also indicated that the *Daubert* factors might be applicable in a trial judge's assessment of the reliability of nonscientific expert testimony, depending upon "the particular circumstances of the particular case at issue." Ibid., at 150.

[16] *Daubert*, 509 U.S. at 596.

[17] See *Gen. Elec. Co. v. Joiner*, 522 U.S. 136, 142-143 (1997).

[18] *Kumho Tire*, 526 U.S. at 153.

*Daubert* and its progeny have engendered confusion and controversy. In particular, judicial dispositions of *Daubert*-type questions in criminal cases have been criticized by some lawyers and scholars who thought that the Supreme Court's decision would be applied more rigorously.[19] If one focuses solely on reported federal appellate decisions, the picture is not appealing to those who have preferred a more rigorous application of *Daubert*. Federal appellate courts have not with any consistency or clarity imposed standards ensuring the application of scientifically valid reasoning and reliable methodology in criminal cases involving *Daubert* questions. This is not really surprising, however. The Supreme Court itself described the *Daubert* standard as "flexible." This means that, beyond questions of relevance, *Daubert* offers appellate courts no clear substantive standard by which to review decisions by trial courts. As a result, trial judges exercise great discretion in deciding whether to admit or exclude expert testimony, and their judgments are subject only to a highly deferential "abuse of discretion" standard of review. Although it is difficult to get a clear picture of how trial courts handle *Daubert* challenges, because many evidentiary rulings are issued without a published opinion and without an appeal, the vast majority of the *reported* opinions in criminal cases indicate that trial judges rarely exclude or restrict expert testimony offered by prosecutors; most *reported* opinions also indicate that appellate courts routinely deny appeals contesting trial court decisions admitting forensic evidence against criminal defendants.[20] But the reported opinions do not offer in any way a complete sample of federal trial court dispositions of *Daubert*-type questions in criminal cases.

The situation appears to be very different in civil cases. Plaintiffs and defendants, equally, are more likely to have access to expert witnesses in civil cases, while prosecutors usually have an advantage over most defendants in offering expert testimony in criminal cases. And, ironically, the appellate courts appear to be more willing to second-guess trial court judgments on the admissibility of purported scientific evidence in civil cases than in criminal cases.[21]

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[19] See, e.g., P.J. Neufeld. 2005. The (near) irrelevance of *Daubert* to criminal justice: And some suggestions for reform. *American Journal of Public Health* 95(Supp.1):S107.

[20] Ibid., p. S109.

[21] See, e.g., *McClain v. Metabolife Int'l, Inc.*, 401 F.3d 1233 (11th Cir. 2005); *Chapman v. Maytag Corp.*, 297 F.3d 682 (7th Cir. 2002); *Goebel v. Denver & Rio Grande W. R.R. Co.*, 215 F.3d 1083 (10th Cir. 2000); *Smith v. Ford Motor Co.*, 215 F.3d 713 (7th Cir. 2000); *Walker v. Soo Line R.R. Co.*, 208 F.3d 581 (7th Cir. 2000); 1 D.L. Faigman, M.J. Saks, J. Sanders, and E.K. Cheng. 2007-2008. *Modern Scientific Evidence: The Law and Science of Expert Testimony.* Eagan, MN: Thomson/West, § 1.35, p. 105 (discussing studies suggesting that courts "employ *Daubert* more lackadaisically in criminal trials—especially in regard to prosecution evidence—than in civil cases—especially in regard to plaintiff evidence").

Prophetically, the *Daubert* decision observed that "there are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory. Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly."[22] But because accused parties in criminal cases are convicted on the basis of testimony from forensic science experts, much depends upon whether the evidence offered is reliable. Furthermore, in addition to protecting innocent persons from being convicted of crimes that they did not commit, we are also seeking to protect society from persons who have committed criminal acts. Law enforcement officials and the members of society they serve need to be assured that forensic techniques are *reliable*. Therefore, we must limit the risk of having the reliability of certain forensic science methodologies judicially certified before the techniques have been properly studied and their accuracy verified by the forensic science community. "[T]here is no evident reason why ['rigorous, systematic'] research would be infeasible."[23] However, some courts appear to be loath to insist on such research as a condition of admitting forensic science evidence in criminal cases, perhaps because to do so would likely "demand more by way of validation than the disciplines can presently offer."[24]

The adversarial process relating to the admission and exclusion of scientific evidence is not suited to the task of finding "scientific truth." The judicial system is encumbered by, among other things, judges and lawyers who generally lack the scientific expertise necessary to comprehend and evaluate forensic evidence in an informed manner, trial judges (sitting alone) who must decide evidentiary issues without the benefit of judicial colleagues and often with little time for extensive research and reflection, and the highly deferential nature of the appellate review afforded trial courts' *Daubert* rulings. Given these realities, there is a tremendous need for the forensic science community to improve. Judicial review, by itself, will not cure the infirmities of the forensic science community.[25] The development

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[22] *Daubert*, 509 U.S. at 596-97.

[23] J. Griffin and D.J. LaMagna. 2002. *Daubert* challenges to forensic evidence: Ballistics next on the firing line. *The Champion*, September-October:20, 21 (quoting P. Giannelli and E. Imwinkelried. 2000. Scientific evidence: The fallout from Supreme Court's decision in *Kumho Tire*. *Criminal Justice Magazine* 14(4):12, 40).

[24] Ibid. See, e.g., *United States v. Crisp*, 324 F.3d 261, 270 (4th Cir. 2003) (noting "that while further research into fingerprint analysis would be welcome, to postpone present in-court utilization of this bedrock forensic identifier pending such research would be to make the best the enemy of the good." (internal quotation marks omitted)).

[25] See J.L. Mnookin. Expert evidence, partisanship, and epistemic competence. 73 BROOK. L. REV. 1009, 1033 (2008) ("[S]o long as we have our adversarial system in much its present form, we are inevitably going to be stuck with approaches to expert evidence that are imperfect, conceptually unsatisfying, and awkward. It may well be that the real lesson is this: those who believe that we might ever fully resolve—rather than imperfectly manage—the

of scientific research, training, technology, and databases associated with DNA analysis have resulted from substantial and steady federal support for both academic research and programs employing techniques for DNA analysis. Similar support must be given to all credible forensic science disciplines if they are to achieve the degrees of reliability needed to serve the goals of justice. With more and better educational programs, accredited laboratories, certified forensic practitioners, sound operational principles and procedures, and serious research to establish the limits and measures of performance in each discipline, forensic science experts will be better able to analyze evidence and coherently report their findings in the courts. The current situation, however, is seriously wanting, both because of the limitations of the judicial system and because of the many problems faced by the forensic science community.

## Political Realities

Most forensic science methods, programs, and evidence are within the regulatory province of state and local law enforcement entities or are covered by statutes and rules governing state judicial proceedings. Thus, in assessing the strengths, weaknesses, and future needs of forensic disciplines, and in making recommendations for improving the use of forensic technologies and techniques, the committee remained mindful of the fact that Congress cannot directly fix all of the deficiencies in the forensic science community. Under our federal system of government, Congress does not have free reign to amend state criminal codes, rules of evidence, and statutes governing civil actions; nor may it easily and directly regulate local law enforcement practices, state and local medical examiner units, or state policies covering the accreditation of crime laboratories and the certification of forensic practitioners.

Congress' authority to act is significant, however. Forensic science programs in federal government entities—whether within DOJ, DHS, DOD, or the Department of Commerce (DOC)—are funded by congressional appropriations. If these programs are required to operate pursuant to the highest standards, they will provide an example for the states. More importantly, Congress can promote "best practices" and strong educational, certification, accreditation, ethics, and oversight programs in the states by offering funds that are contingent on meeting appropriate standards of practice. There is every reason to believe that offers of federal funds with "strings attached" can effect significant change in the forensic science com-

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deep structural tensions surrounding both partisanship and epistemic competence that permeate the use of scientific evidence within our legal system are almost certainly destined for disappointment.").

munity, because so many state and local programs currently are suffering for want of adequate resources. In the end, however, the committee recognized that state and local authorities must be willing to enforce change if it is to happen.

In light of the foregoing issues, the committee exercised caution before drawing conclusions and avoided being too prescriptive in its recommendations. It also recognized that, given the complexity of the issues and the political realities that may pose obstacles to change, some recommendations will have to be implemented creatively and over time in order to be effective.

## FINDINGS AND RECOMMENDATIONS

### The Fragmented System: Symptoms and Cures

The forensic science disciplines currently are an assortment of methods and practices used in both the public and private arenas. Forensic science facilities exhibit wide variability in capacity, oversight, staffing, certification, and accreditation across federal and state jurisdictions. Too often they have inadequate educational programs, and they typically lack mandatory and enforceable standards, founded on rigorous research and testing, certification requirements, and accreditation programs. Additionally, forensic science and forensic pathology research, education, and training lack strong ties to our research universities and national science assets. In addition to the problems emanating from the fragmentation of the forensic science community, the most recently published *Census of Crime Laboratories* conducted by BJS describes unacceptable case backlogs in state and local crime laboratories and estimates the level of additional resources needed to handle these backlogs and prevent their recurrence. Unfortunately, the backlogs, even in DNA case processing, have grown dramatically in recent years and are now staggering in some jurisdictions. The most recently published BJS *Special Report of Medical Examiners and Coroners' Offices* also depicts a system with disparate and often inadequate educational and training requirements, resources, and capacities—in short, a system in need of significant improvement.

Existing data suggest that forensic laboratories are underresourced and understaffed, which contributes to case backlogs and likely makes it difficult for laboratories to do as much as they could to (1) inform investigations, (2) provide strong evidence for prosecutions, and (3) avoid errors that could lead to imperfect justice. Being underresourced also means that the tools of forensic science—and the knowledge base that underpins the analysis and interpretation of evidence—are not as strong as they could be, thus hindering the ability of the forensic science disciplines to excel at

informing investigations, providing strong evidence, and avoiding errors in important ways. NIJ is the only federal agency that provides direct support to crime laboratories to alleviate the backlog, and those funds are minimal. The forensic science system is underresourced also in the sense that it has only thin ties to an academic research base that could support the forensic science disciplines and fill knowledge gaps. There are many hard-working and conscientious people in the forensic science community, but this underresourcing inherently limits their ability to do their best work. Additional resources surely will be necessary to create high-quality, self-correcting systems.

However, increasing the staff within existing crime laboratories and medical examiners' offices is only part of the solution. What also is needed is an upgrading of systems and organizational structures, better training, the widespread adoption of uniform and enforceable best practices, and mandatory certification and accreditation programs. The forensic science community and the medical examiner/coroner system must be upgraded if forensic practitioners are to be expected to serve the goals of justice.

Of the various facets of underresourcing, the committee is most concerned about the knowledge base. Adding more dollars and people to the enterprise might reduce case backlogs, but it will not address fundamental limitations in the capabilities of forensic science disciplines to discern valid information from crime scene evidence. For the most part, it is impossible to discern the magnitude of those limitations, and reasonable people will differ on their significance.

Forensic science research is not well supported, and there is no unified strategy for developing a forensic science research plan across federal agencies. Relative to other areas of science, the forensic disciplines have extremely limited opportunities for research funding. Although the FBI and NIJ have supported some research in forensic science, the level of support has been well short of what is necessary for the forensic science community to establish strong links with a broad base of research universities. Moreover, funding for academic research is limited and requires law enforcement collaboration, which can inhibit the pursuit of more fundamental scientific questions essential to establishing the foundation of forensic science. The broader research community generally is not engaged in conducting research relevant to advancing the forensic science disciplines.

The forensic science enterprise also is hindered by its extreme disaggregation—marked by multiple types of practitioners with different levels of education and training and different professional cultures and standards for performance and a reliance on apprentice-type training and a guild-like structure of disciplines, which work against the goal of a single forensic science profession. Many forensic scientists are given scant opportunity for professional activities, such as attending conferences or

publishing their research, which could help strengthen the professional community and offset some of the disaggregation. The fragmented nature of the enterprise raises the worrisome prospect that the quality of evidence presented in court, and its interpretation, can vary unpredictably according to jurisdiction.

Numerous professional associations are organized around the forensic science disciplines, and many of them are involved in training and education (see Chapter 8) and are developing standards and accreditation and certification programs (see Chapter 7). The efforts of these groups are laudable. However, except for the largest organizations, it is not clear how these associations interact or the extent to which they share requirements, standards, or policies. Thus, there is a need for more consistent and harmonized requirements.

In the course of its deliberations and review of the forensic science enterprise, it became obvious to the committee that, although congressional action will not remedy all of the deficiencies in forensic science methods and practices, truly meaningful advances will not come without significant concomitant leadership from the federal government. The forensic science enterprise lacks the necessary governance structure to pull itself up from its current weaknesses. Of the many professional societies that serve the enterprise, none is dominant, and none has clearly articulated the need for change or presented a vision for accomplishing it. And clearly no municipal or state forensic office has the mandate to lead the entire enterprise. The major federal resources—NIJ and the FBI Laboratory—have provided modest leadership, for which they should be commended: NIJ has contributed a helpful research program and the FBI Laboratory has spearheaded the SWGs. But again, neither entity has recognized, let alone articulated, a need for change or a vision for achieving it. Neither has the full confidence of the larger forensic science community. And because both are part of a prosecutorial department of the government, they could be subject to subtle contextual biases that should not be allowed to undercut the power of forensic science.

The forensic science enterprise needs strong governance to adopt and promote an aggressive, long-term agenda to help strengthen the forensic science disciplines. Governance must be strong enough—and independent enough—to identify the limitations of forensic science methodologies, and must be well connected with the Nation's scientific research base to effect meaningful advances in forensic science practices. The governance structure must be able to create appropriate incentives for jurisdictions to adopt and adhere to best practices and promulgate the necessary sanctions to discourage bad practices. It must have influence with educators in order to effect improvements to forensic science education. It must be able to identify standards and enforce them. A governance entity must be geared toward

(and be credible within) the law enforcement community, but it must have strengths that extend beyond that area. Oversight of the forensic science community and medical examiner system will sweep broadly into areas of criminal investigation and prosecution, civil litigation, legal reform, investigation of insurance claims, national disaster planning and preparedness, homeland security, certification of federal, state, and local forensic practitioners, public health, accreditation of public and private laboratories, research to improve forensic methodologies, education programs in colleges and universities, and advancing technology.

The committee considered whether such a governing entity could be established within an existing federal agency. The National Science Foundation (NSF) was considered because of its strengths in leading research and its connections to the research and education communities. NSF is surely capable of building and sustaining a research base, but it has very thin ties to the forensic science community. It would be necessary for NSF to take many untested steps if it were to assume responsibility for the governance of applied fields of science. The committee also considered NIST. In the end analysis, however, NIST did not appear to be a viable option. It has a good program of research targeted at forensic science and law enforcement, but the program is modest. NIST also has strong ties to industry and academia, and it has an eminent history in standard setting and method development. But its ties to the forensic science community are still limited, and it would not be seen as a natural leader by the scholars, scientists, and practitioners in the field. In sum, the committee concluded that neither NSF nor NIST has the breadth of experience or institutional capacity to establish an effective governance structure for the forensic science enterprise.

There was also a strong consensus in the committee that no existing or new division or unit within DOJ would be an appropriate location for a new entity governing the forensic science community. DOJ's principal mission is to enforce the law and defend the interests of the United States according to the law. Agencies within DOJ operate pursuant to this mission. The FBI, for example, is the investigative arm of DOJ and its principal missions are to produce and use intelligence to protect the Nation from threats and to bring to justice those who violate the law. The work of these law enforcement units is critically important to the Nation, but the scope of the work done by DOJ units is much narrower than the promise of a strong forensic science community. Forensic science serves more than just law enforcement; and when it does serve law enforcement, it must be equally available to law enforcement officers, prosecutors, *and* defendants in the criminal justice system. The entity that is established to govern the forensic science community cannot be principally beholden to law enforcement. The potential for conflicts of interest between the needs of law enforcement and the broader needs of forensic science are too great. In addition, the com-

mittee determined that the research funding strategies of DOJ have not adequately served the broad needs of the forensic science community. This is understandable, but not acceptable when the issue is whether an agency is best suited to support and oversee the Nation's forensic science community. In sum, the committee concluded that advancing *science* in the forensic science enterprise is not likely to be achieved within the confines of DOJ.

Furthermore, there is little doubt that some existing federal entities are too wedded to the current "fragmented" forensic science community, which is deficient in too many respects. Most notably, these existing agencies have failed to pursue a rigorous research agenda to confirm the evidentiary reliability of methodologies used in a number of forensic science disciplines. These agencies are not good candidates to oversee the overhaul of the forensic science community in the United States.

Finally, some existing federal agencies with other missions occasionally have undertaken projects affecting the forensic science community. These entities are better left to continue the good work that defines their principal missions. More responsibility is not better for these existing entities, nor would it be better for the forensic science community or the Nation.

The committee thus concluded that the problems at issue are too serious and important to be subsumed by an existing federal agency. It also concluded that no existing federal agency has the capacity or appropriate mission to take on the roles and responsibilities needed to govern and improve the forensic science enterprise.

The committee believes that what is needed to support and oversee the forensic science community is a new, strong, and independent entity that could take on the tasks that would be assigned to it in a manner that is as objective and free of bias as possible—one with no ties to the past and with the authority and resources to implement a fresh agenda designed to address the problems found by the committee and discussed in this report. A new organization should not be encumbered by the assumptions, expectations, and deficiencies of the existing fragmented infrastructure, which has failed to address the needs and challenges of the forensic science disciplines.

This new entity must be an independent federal agency established to address the needs of the forensic science community, and it must meet the following minimum criteria:

- It must have a culture that is strongly rooted in science, with strong ties to the national research and teaching communities, including federal laboratories.
- It must have strong ties to state and local forensic entities as well as to the professional organizations within the forensic science community.

- It must not be in any way committed to the existing system, but should be informed by its experiences.
- It must not be part of a law enforcement agency.
- It must have the funding, independence, and sufficient prominence to raise the profile of the forensic science disciplines and push effectively for improvements.
- It must be led by persons who are skilled and experienced in developing and executing national strategies and plans for standard setting; managing accreditation and testing processes; and developing and implementing rulemaking, oversight, and sanctioning processes.

No federal agency currently exists that meets all of these criteria.

**Recommendation 1:**

**To promote the development of forensic science into a mature field of multidisciplinary research and practice, founded on the systematic collection and analysis of relevant data, Congress should establish and appropriate funds for an independent federal entity, the National Institute of Forensic Science (NIFS). NIFS should have a full-time administrator and an advisory board with expertise in research and education, the forensic science disciplines, physical and life sciences, forensic pathology, engineering, information technology, measurements and standards, testing and evaluation, law, national security, and public policy. NIFS should focus on:**

**(a) establishing and enforcing best practices for forensic science professionals and laboratories;**
**(b) establishing standards for the mandatory accreditation of forensic science laboratories and the mandatory certification of forensic scientists and medical examiners/forensic pathologists—and identifying the entity/entities that will develop and implement accreditation and certification;**
**(c) promoting scholarly, competitive peer-reviewed research and technical development in the forensic science disciplines and forensic medicine;**
**(d) developing a strategy to improve forensic science research and educational programs, including forensic pathology;**
**(e) establishing a strategy, based on accurate data on the forensic science community, for the efficient allocation of available funds to give strong support to forensic methodologies and practices in addition to DNA analysis;**

(f) **funding state and local forensic science agencies, independent research projects, and educational programs as recommended in this report, with conditions that aim to advance the credibility and reliability of the forensic science disciplines;**
(g) **overseeing education standards and the accreditation of forensic science programs in colleges and universities;**
(h) **developing programs to improve understanding of the forensic science disciplines and their limitations within legal systems; and**
(i) **assessing the development and introduction of new technologies in forensic investigations, including a comparison of new technologies with former ones.**

The benefits that will flow from a strong, independent, strategic, coherent, and well-funded federal program to support and oversee the forensic science disciplines in this country are clear: The Nation will (1) bolster its ability to more accurately identify true perpetrators and exclude those who are falsely accused; (2) improve its ability to effectively respond to, attribute, and prosecute threats to homeland security; and (3) reduce the likelihood of convictions resting on inaccurate data. Moreover, establishing the scientific foundation of the forensic science disciplines, providing better education and training, and requiring certification and accreditation will position the forensic science community to take advantage of current and future scientific advances.

The creation of a new federal entity undoubtedly will pose challenges, not the least of which will be budgetary constraints. The committee is not in a position to estimate how much it will cost to implement the recommendations in this report; this is a matter best left to the expertise of the Congressional Budget Office. What is clear, however, is that Congress must take aggressive action if the worst ills of the forensic science community are to be cured. Political and budgetary concerns should not deter bold, creative, and forward-looking action, because the country cannot afford to suffer the consequences of inaction. It will also take time and patience to implement the recommendations in this report. But this is true with any large, complex, important, and challenging enterprise.

The committee strongly believes that the greatest hope for success in this enterprise will come with the creation of the National Institute of Forensic Science (NIFS) to oversee and direct the forensic science community. The remaining recommendations in this report are crucially tied to the creation of NIFS. However, each recommendation is a separate, essential piece of the plan to improve the forensic science community in the United States. Therefore, even if the creation of NIFS is forestalled, the committee

vigorously supports the adoption of the core ideas and principles embedded in each of the following recommendations.

### *Standardized Terminology and Reporting*

The terminology used in reporting and testifying about the results of forensic science investigations must be standardized. Many terms are used by forensic scientists in scientific reports and in court testimony that describe findings, conclusions, and degrees of association between evidentiary material (e.g., hairs, fingerprints, fibers) and particular people or objects. Such terms include, but are not limited to "match," "consistent with," "identical," "similar in all respects tested," and "cannot be excluded as the source of." The use of such terms can and does have a profound effect on how the trier of fact in a criminal or civil matter perceives and evaluates scientific evidence. Although some forensic science disciplines have proposed reporting vocabulary and scales, the use of the recommended language is not standard practice among forensic science practitioners.

As a general matter, laboratory reports generated as the result of a scientific analysis should be complete and thorough. They should contain, at minimum, "methods and materials," "procedures," "results," "conclusions," and, as appropriate, sources and magnitudes of uncertainty in the procedures and conclusions (e.g., levels of confidence). Some forensic science laboratory reports meet this standard of reporting, but many do not. Some reports contain only identifying and agency information, a brief description of the evidence being submitted, a brief description of the types of analysis requested, and a short statement of the results (e.g., "the greenish, brown plant material in item #1 was identified as marijuana"), and they include no mention of methods or any discussion of measurement uncertainties.

Many clinical and testing disciplines outside the forensic science disciplines have standards, templates, and protocols for data reporting. A good example is the ISO/IEC 17025 standard (commonly called "ISO 17025"). ISO 17025 is an international standard published by the International Organization for Standardization (ISO) that specifies the general requirements for the competence to carry out tests and/or calibrations. These requirements have been used by accrediting agencies to determine what a laboratory must do to secure accreditation. In addition, some SWGs in the forensic disciplines have scoring systems for reporting findings, but these systems are neither uniformly nor consistently used. In other words, although appropriate standards exist, they are not always followed. Forensic reports, and any courtroom testimony stemming from them, must include clear characterizations of the limitations of the analyses, including measures

of uncertainty in reported results and associated estimated probabilities where possible.

**Recommendation 2:**

**The National Institute of Forensic Science (NIFS), after reviewing established standards such as ISO 17025, and in consultation with its advisory board, should establish standard terminology to be used in reporting on and testifying about the results of forensic science investigations. Similarly, it should establish model laboratory reports for different forensic science disciplines and specify the minimum information that should be included. As part of the accreditation and certification processes, laboratories and forensic scientists should be required to utilize model laboratory reports when summarizing the results of their analyses.**

*More and Better Research*

As noted above, some forensic science disciplines are supported by little rigorous systematic research to validate the discipline's basic premises and techniques. There is no evident reason why such research cannot be conducted. Much more federal funding is needed to support research in the forensic science disciplines and forensic pathology in universities and private laboratories committed to such work.

The forensic science and medical examiner communities will be improved by opportunities to collaborate with the broader science and engineering communities. In particular, there is an urgent need for collaborative efforts to (1) develop new technical methods or provide in-depth grounding for advances developed in the forensic science disciplines; (2) provide an interface between the forensic science and medical examiner communities and basic sciences; and (3) create fertile ground for discourse among the communities. NIFS should recommend, implement, and guide strategies for supporting such initiatives.

**Recommendation 3:**

**Research is needed to address issues of accuracy, reliability, and validity in the forensic science disciplines. The National Institute of Forensic Science (NIFS) should competitively fund peer-reviewed research in the following areas:**

**(a) Studies establishing the scientific bases demonstrating the validity of forensic methods.**

(b) The development and establishment of quantifiable measures of the reliability and accuracy of forensic analyses. Studies of the reliability and accuracy of forensic techniques should reflect actual practice on realisticcase scenarios, averaged across a representative sample of forensic scientists and laboratories. Studies also should establish the limits of reliability and accuracy that analytic methods can be expected to achieve as the conditions of forensic evidence vary. The research by which measures of reliability and accuracy are determined should be peer reviewed and published in respected scientific journals.
(c) The development of quantifiable measures of uncertainty in the conclusions of forensic analyses.
(d) Automated techniques capable of enhancing forensic technologies.

To answer questions regarding the reliability and accuracy of a forensic analysis, the research needs to distinguish between average performance (achieved across individual practitioners and laboratories) and individual performance (achieved by the specific practitioner and laboratory). Whether a forensic procedure is sufficient under the rules of evidence governing criminal and civil litigation raises difficult legal issues that are outside the realm of scientific inquiry. (Some of the legal issues are addressed in Chapter 3.)

*Best Practices and Standards*

Although there have been notable efforts to achieve standardization and develop best practices in some forensic science disciplines and the medical examiner system, most disciplines still lack best practices or any coherent structure for the enforcement of operating standards, certification, and accreditation. Standards and codes of ethics exist in some fields, and there are some functioning certification and accreditation programs, but none are mandatory. In short, oversight and enforcement of operating standards, certification, accreditation, and ethics are lacking in most local and state jurisdictions.

Scientific and medical assessment conducted in forensic investigations should be independent of law enforcement efforts either to prosecute criminal suspects or even to determine whether a criminal act has indeed been committed. Administratively, this means that forensic scientists should function independently of law enforcement administrators. The best science is conducted in a scientific setting as opposed to a law enforcement setting. Because forensic scientists often are driven in their work by a need to answer a particular question related to the issues of a particular case,

they sometimes face pressure to sacrifice appropriate methodology for the sake of expediency.

Recommendation 4:

> To improve the scientific bases of forensic science examinations and to maximize independence from or autonomy within the law enforcement community, Congress should authorize and appropriate incentive funds to the National Institute of Forensic Science (NIFS) for allocation to state and local jurisdictions for the purpose of removing all public forensic laboratories and facilities from the administrative control of law enforcement agencies or prosecutors' offices.

Recommendation 5:

> The National Institute of Forensic Science (NIFS) should encourage research programs on human observer bias and sources of human error in forensic examinations. Such programs might include studies to determine the effects of contextual bias in forensic practice (e.g., studies to determine whether and to what extent the results of forensic analyses are influenced by knowledge regarding the background of the suspect and the investigator's theory of the case). In addition, research on sources of human error should be closely linked with research conducted to quantify and characterize the amount of error. Based on the results of these studies, and in consultation with its advisory board, NIFS should develop standard operating procedures (that will lay the foundation for model protocols) to minimize, to the greatest extent reasonably possible, potential bias and sources of human error in forensic practice. These standard operating procedures should apply to all forensic analyses that may be used in litigation.

Recommendation 6:

> To facilitate the work of the National Institute of Forensic Science (NIFS), Congress should authorize and appropriate funds to NIFS to work with the National Institute of Standards and Technology (NIST), in conjunction with government laboratories, universities, and private laboratories, and in consultation with Scientific Working Groups, to develop tools for advancing measurement, validation, reliability, information sharing, and proficiency testing in forensic science and to establish protocols for forensic examina-

tions, methods, and practices. Standards should reflect best practices and serve as accreditation tools for laboratories and as guides for the education, training, and certification of professionals. Upon completion of its work, NIST and its partners should report findings and recommendations to NIFS for further dissemination and implementation.

*Quality Control, Assurance, and Improvement*

In a field such as medical diagnostics, a health care provider typically can track a patient's progress to see whether the original diagnosis was accurate and helpful. For example, widely accepted programs of quality control ensure timely feedback involving the diagnoses that result from mammography. Other examples of quality assurance and improvement—including the development of standardized vocabularies, ontologies, and scales for interpreting diagnostic tests and developing standards for accreditation of services—pervade diagnostic medicine. This type of systematic and routine feedback is an essential element of any field striving for continuous improvement. The forensic science disciplines likewise must become a self-correcting enterprise, developing and implementing feedback loops that allow the profession to discover past mistakes. A particular need exists for routine, mandatory proficiency testing that emulates a realistic, representative cross-section of casework, for example, DNA proficiency testing.

Recommendation 7:

Laboratory accreditation and individual certification of forensic science professionals should be mandatory, and all forensic science professionals should have access to a certification process. In determining appropriate standards for accreditation and certification, the National Institute of Forensic Science (NIFS) should take into account established and recognized international standards, such as those published by the International Organization for Standardization (ISO). No person (public or private) should be allowed to practice in a forensic science discipline or testify as a forensic science professional without certification. Certification requirements should include, at a minimum, written examinations, supervised practice, proficiency testing, continuing education, recertification procedures, adherence to a code of ethics, and effective disciplinary procedures. All laboratories and facilities (public or private) should be accredited, and all forensic science professionals should be certified, when eligible, within a time period established by NIFS.

**Recommendation 8:**

**Forensic laboratories should establish routine quality assurance and quality control procedures to ensure the accuracy of forensic analyses and the work of forensic practitioners. Quality control procedures should be designed to identify mistakes, fraud, and bias; confirm the continued validity and reliability of standard operating procedures and protocols; ensure that best practices are being followed; and correct procedures and protocols that are found to need improvement.**

### *Codes of Ethics*

A number of forensic science organizations—such as AAFS, the Midwestern Association of Forensic Scientists, ASCLD, and NAME—have adopted codes of ethics. The codes that exist are sometimes comprehensive, but they vary in content. While there is no reason to doubt that many forensic scientists understand their ethical obligations and practice in an ethical way, there are no consistent mechanisms for enforcing any of the existing codes of ethics. Many jurisdictions do not require certification in the same way that, for example, states require lawyers to be licensed. Therefore, few forensic science practitioners face the threat of official sanctions or loss of certification for serious ethical violations. And it is unclear whether and to what extent forensic science practitioners are required to adhere to ethics standards as a condition of employment.

**Recommendation 9:**

**The National Institute of Forensic Science (NIFS), in consultation with its advisory board, should establish a national code of ethics for all forensic science disciplines and encourage individual societies to incorporate this national code as part of their professional code of ethics. Additionally, NIFS should explore mechanisms of enforcement for those forensic scientists who commit serious ethical violations. Such a code could be enforced through a certification process for forensic scientists.**

### *Insufficient Education and Training*

Forensic science examiners need to understand the principles, practices, and contexts of scientific methodology, as well as the distinctive features of their specialty. Ideally, training should move beyond apprentice-like

transmittal of practices to education based on scientifically valid principles. In addition to the practical experience and learning acquired during an internship, a trainee should acquire rigorous interdisciplinary education and training in the scientific areas that constitute the basis for the particular forensic discipline and instruction on how to document and report the analysis. A trainee also should have working knowledge of basic quantitative calculations, including statistics and probability, as needed for the applicable discipline.

To correct some of the existing deficiencies, it is crucially important to improve undergraduate and graduate forensic science programs. Legitimization of practices in forensic disciplines must be based on established scientific knowledge, principles, and practices, which are best learned through formal education. Apprenticeship has a secondary role, and under no circumstances can it supplant the need for the scientific basis of education in and the practice of forensic science.

In addition, lawyers and judges often have insufficient training and background in scientific methodology, and they often fail to fully comprehend the approaches employed by different forensic science disciplines and the reliability of forensic science evidence that is offered in trial. Such training is essential, because any checklist for the admissibility of scientific or technical testimony is imperfect. Conformance with items on a checklist can suggest that testimony is reliable, but it does not guarantee it. Better connections must be established and promoted between experts in the forensic science disciplines and law schools, legal scholars, and practitioners. The fruits of any advances in the forensic science disciplines should be transferred directly to legal scholars and practitioners (including civil litigators, prosecutors, and criminal defense counsel), federal, state, and local legislators, members of the judiciary, and law enforcement officials, so that appropriate adjustments can be made in criminal and civil laws and procedures, model jury instructions, law enforcement practices, litigation strategies, and judicial decisionmaking. Law schools should enhance this connection by offering courses in the forensic science disciplines, by offering credit for forensic science courses taken in other colleges, and by developing joint degree programs. And judges need to be better educated in forensic science methodologies and practices.

**Recommendation 10:**

**To attract students in the physical and life sciences to pursue graduate studies in multidisciplinary fields critical to forensic science practice, Congress should authorize and appropriate funds to the National Institute of Forensic Science (NIFS) to work with appropriate organizations and educational institutions to improve and**

**develop graduate education programs designed to cut across organizational, programmatic, and disciplinary boundaries. To make these programs appealing to potential students, they must include attractive scholarship and fellowship offerings. Emphasis should be placed on developing and improving research methods and methodologies applicable to forensic science practice and on funding research programs to attract research universities and students in fields relevant to forensic science. NIFS should also support law school administrators and judicial education organizations in establishing continuing legal education programs for law students, practitioners, and judges.**

### *The Medicolegal Death Investigation System*

Although steps have been taken to transform the medicolegal death investigation system, the shortage of resources and lack of consistent educational and training requirements (particularly in the coroner system)[26] prevent the system from taking full advantage of tools—such as CT scans and digital X-rays—that the medical system and other scientific disciplines have to offer. In addition, more rigorous efforts are needed in the areas of accreditation and adherence to standards. Currently, requirements for practitioners vary from nothing more than age and residency requirements to certification by the American Board of Pathology in forensic pathology.

Funds are needed to assess the medicolegal death investigation system to determine its status and needs, using as a benchmark the current requirements of NAME relating to professional credentials, standards, and accreditation. And funds are needed to modernize and improve the medicolegal death investigation system. As it now stands, medical examiners and coroners (ME/Cs) are essentially ineligible for direct federal funding and grants from DOJ, DHS, or the Department of Health and Human Services (through the National Institutes of Health). The Paul Coverdell National Forensic Science Improvement Act is the only federal grant program that names medical examiners and coroners as eligible for grants. However, ME/Cs must compete with public safety agencies for Coverdell grants; as a result, the funds available to ME/Cs are inadequate. The simple reality is that the program has not been sufficiently funded to provide significant improvements in ME/C systems.

In addition to direct funding, there are other initiatives that should be pursued to improve the medicolegal death investigation system. The Association of American Medical Colleges and other appropriate profes-

[26] Institute of Medicine. 2003. *Workshop on the Medicolegal Death Investigation System.* Washington, DC: The National Academies Press.

sional organizations should organize collaborative activities in education, training, and research to strengthen the relationship between the medical examiner community and its counterparts in the larger academic medical community. Medical examiner offices with training programs affiliated with medical schools should be eligible to compete for funds. Funding should be available to support pathologists seeking forensic fellowships. In addition, forensic pathology fellows could be allowed to apply for medical school loan forgiveness if they stay full time at a medical examiner's office for a reasonable period of time.

Additionally, NIFS should seek funding from Congress to support the joint development of programs to include medical examiners and medical examiner offices in national disaster planning, preparedness, and consequence management, involving the Centers for Disease Control and Prevention (CDC) and DHS. Uniform statewide and interstate standards of operation would be needed to assist in the management of cross-jurisdictional and interstate events. NIFS should support a federal program underwriting the development of software for use by ME/C systems for the management of multisite, multiple fatality events.

NIFS should work with groups such as the National Conference of Commissioners on Uniform State Laws, the American Law Institute, and NAME, in collaboration with other appropriate professional groups, to update the 1954 Model Post-Mortem Examinations Act and draft legislation for a modern model death investigation code. An improved code might, for example, include the elements of a competent medical death investigation system and clarify the jurisdiction of the medical examiner with respect to organ donation.

The foregoing ideas must be developed further before any concrete plans can be pursued. There are, however, a number of specific recommendations, which, if adopted, will help to modernize and improve the medicolegal death investigation system. These recommendations deserve the immediate attention of Congress and NIFS.

**Recommendation 11:**

**To improve medicolegal death investigation:**

**(a) Congress should authorize and appropriate incentive funds to the National Institute of Forensic Science (NIFS) for allocation to states and jurisdictions to establish medical examiner systems, with the goal of replacing and eventually eliminating existing coroner systems. Funds are needed to build regional medical examiner offices, secure necessary equipment, improve administration, and ensure the**

education, training, and staffing of medical examiner offices. Funding could also be used to help current medical examiner systems modernize their facilities to meet current Centers for Disease Control and Prevention-recommended autopsy safety requirements.

(b) Congress should appropriate resources to the National Institutes of Health (NIH) and NIFS, jointly, to support research, education, and training in forensic pathology. NIH, with NIFS participation, or NIFS in collaboration with content experts, should establish a study section to establish goals, to review and evaluate proposals in these areas, and to allocate funding for collaborative research to be conducted by medical examiner offices and medical universities. In addition, funding, in the form of medical student loan forgiveness and/or fellowship support, should be made available to pathology residents who choose forensic pathology as their specialty.

(c) NIFS, in collaboration with NIH, the National Association of Medical Examiners, the American Board of Medicolegal Death Investigators, and other appropriate professional organizations, should establish a Scientific Working Group (SWG) for forensic pathology and medicolegal death investigation. The SWG should develop and promote standards for best practices, administration, staffing, education, training, and continuing education for competent death scene investigation and postmortem examinations. Best practices should include the utilization of new technologies such as laboratory testing for the molecular basis of diseases and the implementation of specialized imaging techniques.

(d) All medical examiner offices should be accredited pursuant to NIFS-endorsed standards within a timeframe to be established by NIFS.

(e) All federal funding should be restricted to accredited offices that meet NIFS-endorsed standards or that demonstrate significant and measurable progress in achieving accreditation within prescribed deadlines.

(f) All medicolegal autopsies should be performed or supervised by a board certified forensic pathologist. This requirement should take effect within a timeframe to be established by NIFS, following consultation with governing state institutions.

*AFIS and Database Interoperability*

Great improvement is necessary in AFIS interoperability. Crimes may go unsolved today simply because it is not possible for investigating agencies to search across all the databases that might hold a suspect's fingerprints or that may contain a match for an unidentified latent print from a crime scene. It is also possible that some individuals have been wrongly convicted because of the limitations of fingerprint searches.

At present, serious practical problems pose obstacles to the achievement of nationwide AFIS interoperability. These problems include convincing AFIS equipment vendors to cooperate and collaborate with the law enforcement community and researchers to create and use baseline standards for sharing fingerprint data and create a common interface. Second, law enforcement agencies lack the resources needed to transition to interoperable AFIS implementations. Third, coordinated jurisdictional agreements and public policies are needed to allow law enforcement agencies to share fingerprint data more broadly.

Given the disparity in resources and information technology expertise available to local, state, and federal law enforcement agencies, the relatively slow pace of interoperability efforts to date, and the potential gains from increased AFIS interoperability, the committee believes that a broad-based emphasis on achieving nationwide fingerprint data interoperability is needed.

**Recommendation 12:**

**Congress should authorize and appropriate funds for the National Institute of Forensic Science (NIFS) to launch a new broad-based effort to achieve nationwide fingerprint data interoperability. To that end, NIFS should convene a task force comprising relevant experts from the National Institute of Standards and Technology and the major law enforcement agencies (including representatives from the local, state, federal, and, perhaps, international levels) and industry, as appropriate, to develop:**

**(a) standards for representing and communicating image and minutiae data among Automated Fingerprint Identification Systems. Common data standards would facilitate the sharing of fingerprint data among law enforcement agencies at the local, state, federal, and even international levels, which could result in more solved crimes, fewer wrongful identifications, and greater efficiency with respect to fingerprint searches; and**

(b) **baseline standards—to be used with computer algorithms—to map, record, and recognize features in fingerprint images, and a research agenda for the continued improvement, refinement, and characterization of the accuracy of these algorithms (including quantification of error rates).**

These steps toward AFIS interoperability must be accompanied by federal, state, and local funds to support jurisdictions in upgrading, operating, and ensuring the integrity and security of their systems; retraining current staff; and training new fingerprint examiners to gain the desired benefits of true interoperability. Additionally, greater scientific benefits can be realized through the availability of fingerprint data or databases for research purposes (using, of course, all the modern security and privacy protections available to scientists when working with such data). Once created, NIFS might also be tasked with the maintenance and periodic review of the new standards and procedures.

*Forensic Science Disciplines and Homeland Security*

Good forensic science and medical examiner practices are of clear value from a homeland security perspective, because of their roles in bringing criminals to justice and in dealing with the effects of natural and human-made mass disasters. Forensic science techniques (e.g., the evaluation of DNA fragments) enable more thorough investigations of crime scenes that have been damaged physically. Routine and trustworthy collection of digital evidence, and improved techniques and timeliness for its analysis, can be of great potential value in identifying terrorist activity. Therefore, the forensic science community has a role to play in homeland security. However, to capitalize on this potential, the forensic science and medical examiner communities must be well interfaced with homeland security efforts, so that they can contribute when needed. To be successful, this interface will require the establishment of good working relationships between federal, state, and local jurisdictions, the creation of strong security programs to protect data transmittals between jurisdictions, the development of additional training for forensic scientists and crime scene investigators, and the promulgation of contingency plans that will promote efficient team efforts on demand. Policy issues relating to the enforcement of homeland security are not within the scope of the committee's charge and, thus, are beyond the scope of the report. It can hardly be doubted, however, that improvements in the forensic science community and medical examiner system could greatly enhance the capabilities of homeland security.

Recommendation 13:

> Congress should provide funding to the National Institute of Forensic Science (NIFS) to prepare, in conjunction with the Centers for Disease Control and Prevention and the Federal Bureau of Investigation, forensic scientists and crime scene investigators for their potential roles in managing and analyzing evidence from events that affect homeland security, so that maximum evidentiary value is preserved from these unusual circumstances and the safety of these personnel is guarded. This preparation also should include planning and preparedness (to include exercises) for the interoperability of local forensic personnel with federal counterterrorism organizations.

Attachment B

PowerPoint presentation slides
by Anjali R. Swienton, M.F.S., J.D.

# 6th Circuit Judicial Conference

## Revisiting Old Convictions Using New Technology, and New Views of Old Technology

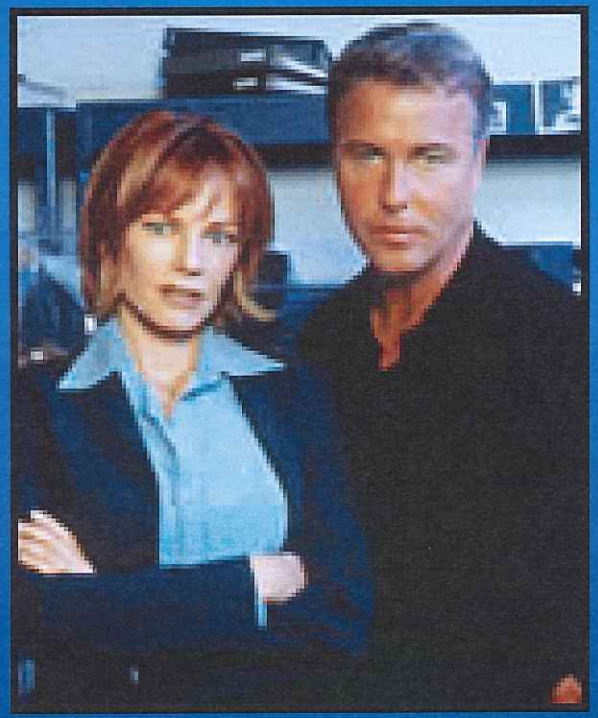
Anjali R. Swienton, MFS, JD

May 6, 2010

SciLaw Forensics, Ltd.

# CSI:

CRIME SCENE INVESTIGATION



# Caselaw

Delaware Supreme Court recently ruled that a judge should have corrected a prosecutor who complained to a jury that the standard for guilt was no longer "beyond a reasonable doubt" but "the TV expectation the [criminal defendants] hope folks like you want. Can they meet CSI?" Ruled harmless error. Boatswain v. State, 872 A 2d 959 ( Del. 2005)

# Caselaw

State v. Latham, 114 P 3d 1000 ( Kan Ct App 2005)

- Defense objected to prosecutor's comment during *voir dire* that certain types of tests on evidence on TV were not technologically possible and if they expect CSI evidence
- Held comment not prejudicial

# Using new technologies to resolve old questions and/or to clarify results

- When the results of more advanced technologies run counter to earlier data, what does that mean about the original tests?

- PUT IT IN PERSPECTIVE!

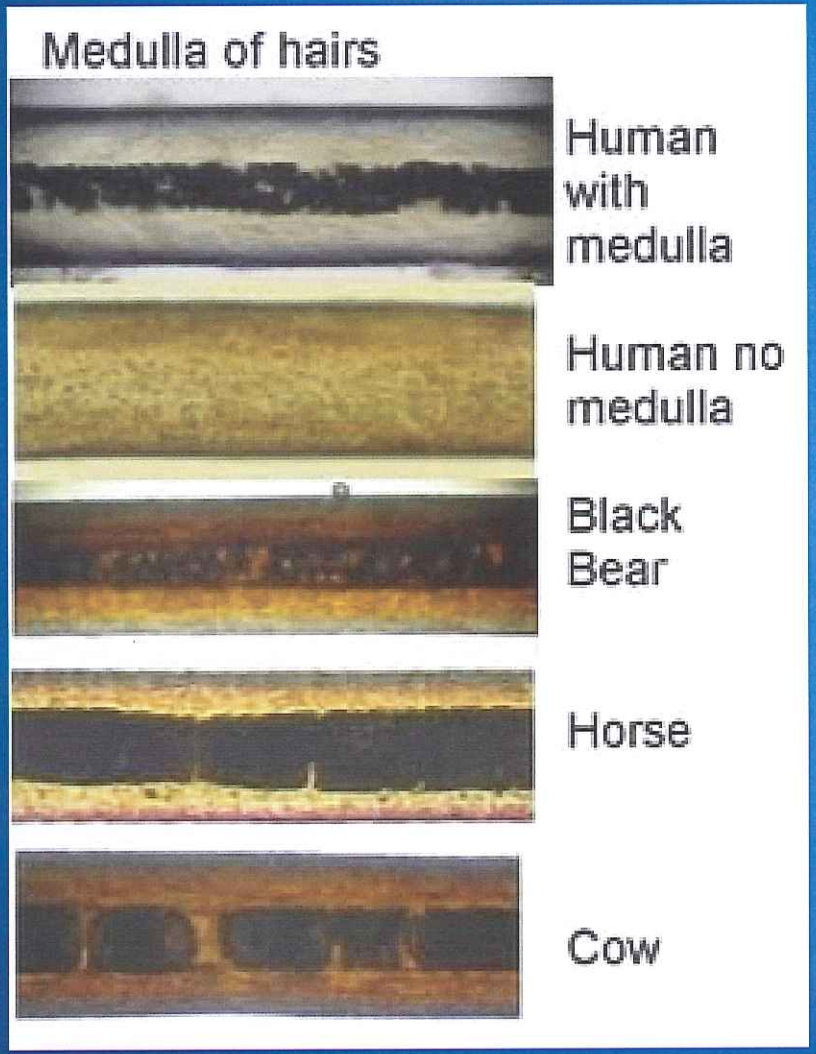
- Some older technologies were state-of-the-art at the time:

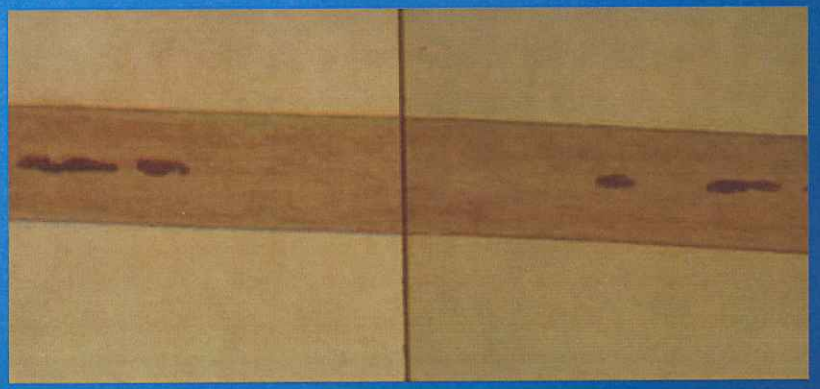
- Serology
- Microscopic hair comparison

- While others may have been a stretch even back then:

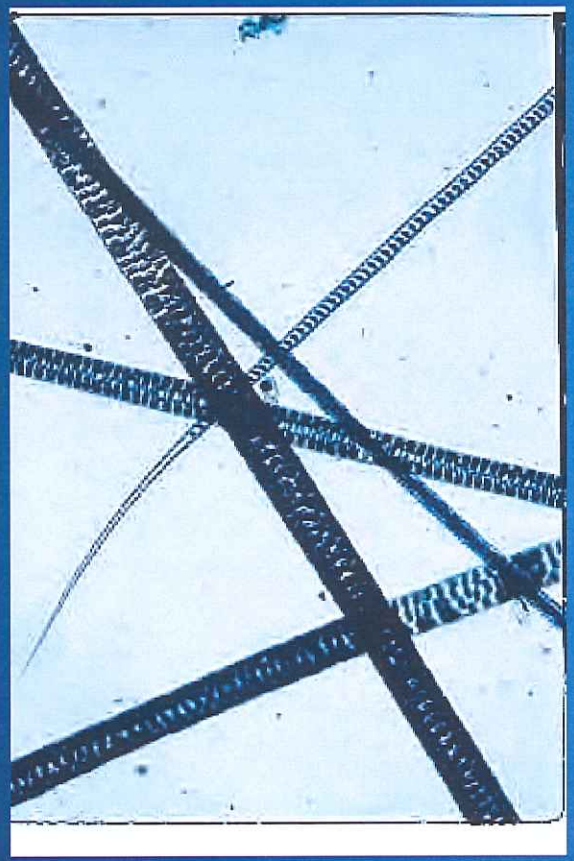
- Bitemark comparisons

# Microscopic Hair Comparison

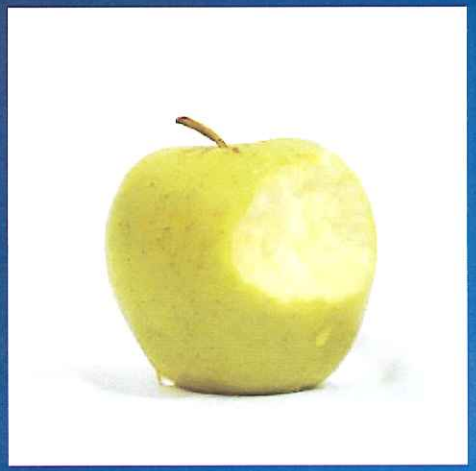


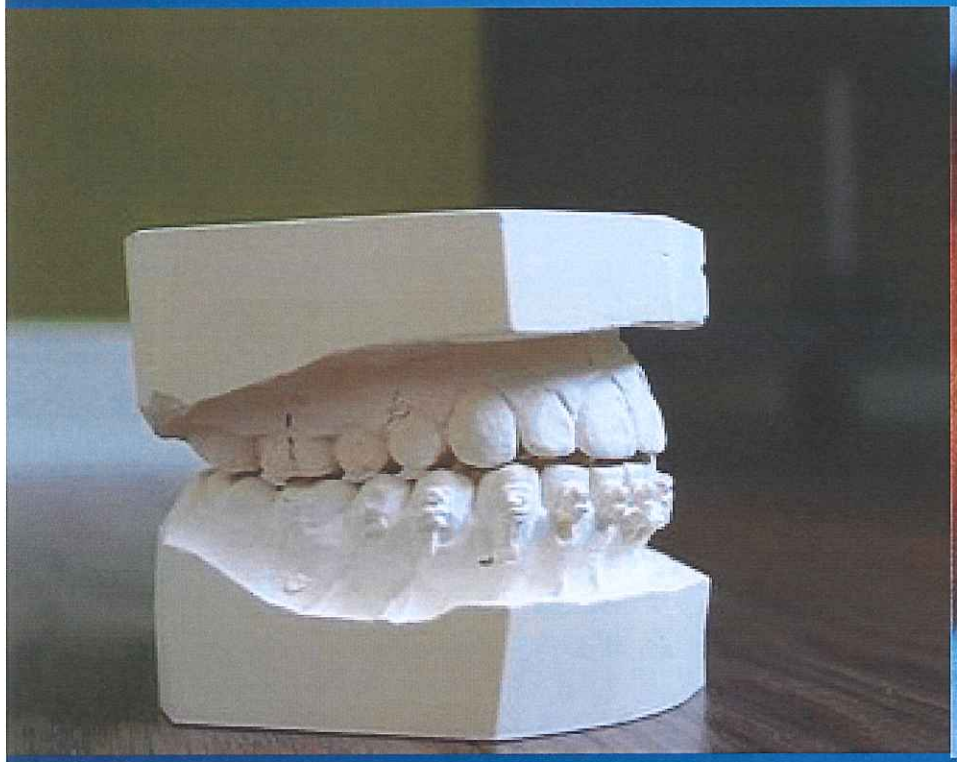
# Hair Analysis

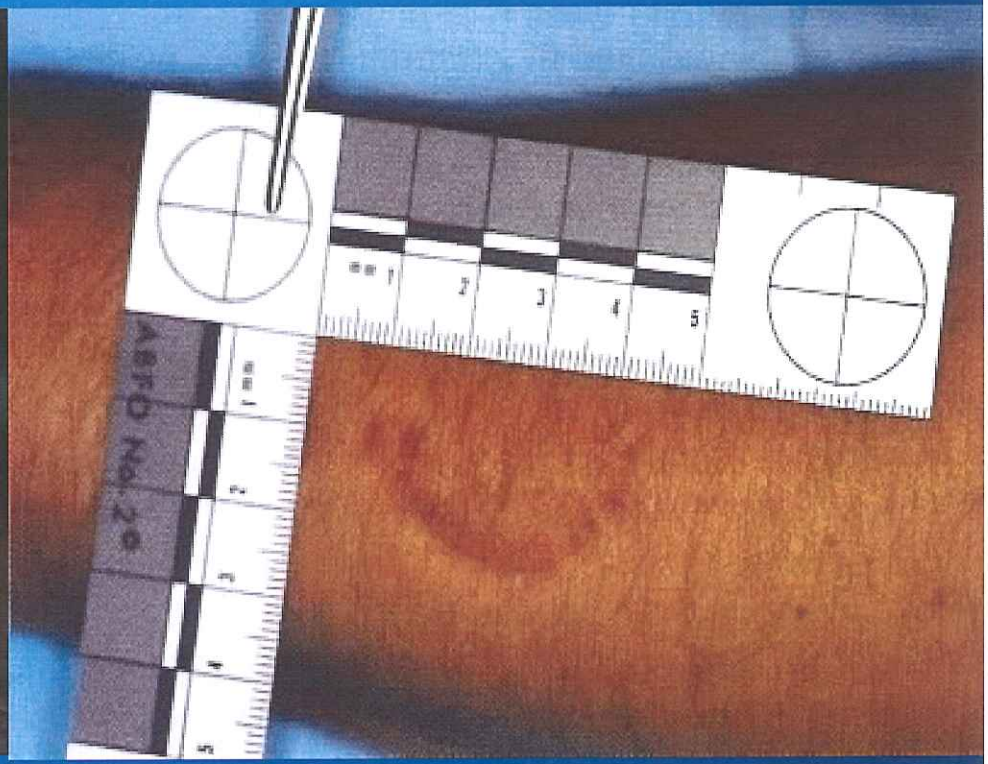


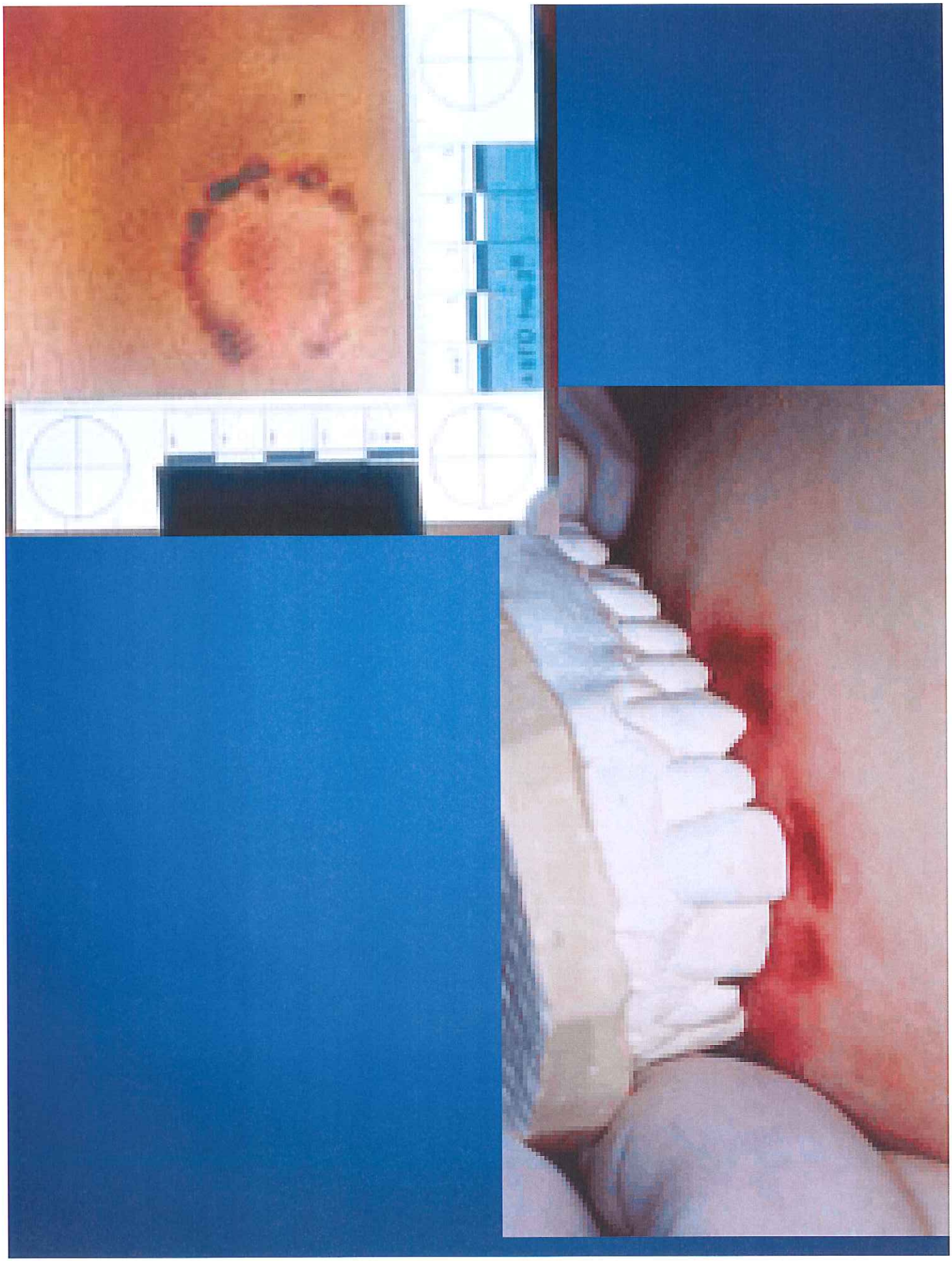
- *Daubert* has been successfully applied to Spectrophotometer and Gas Chromatographic tests for detecting the past use of drugs but microscopic hair comparison has had numerous challenges



# Bitemarks



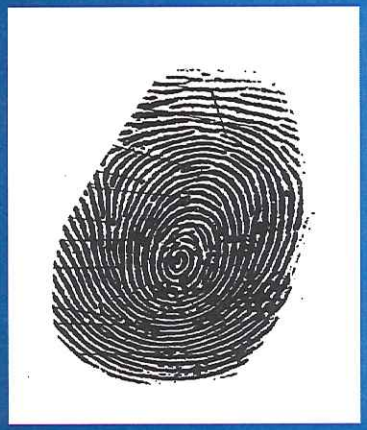


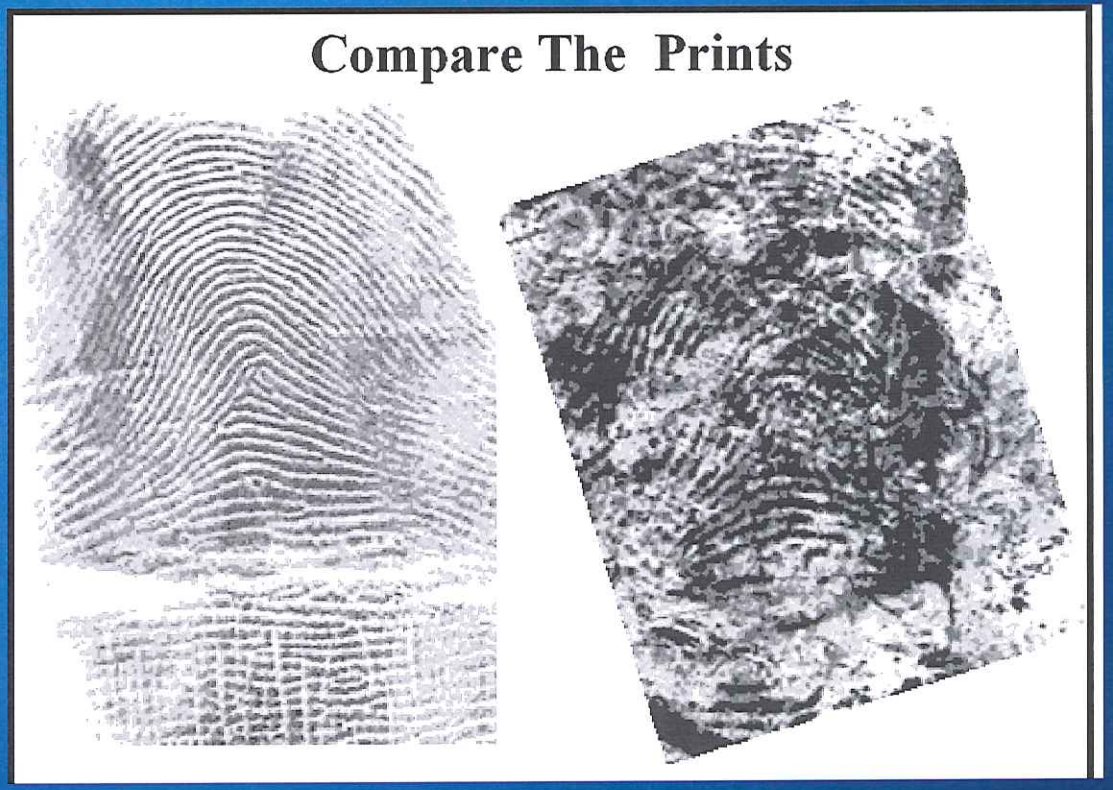


# Eyewitness Identification

- Generally FAILS the *Daubert test*, for the most part, as most social science, like social psychology, does.

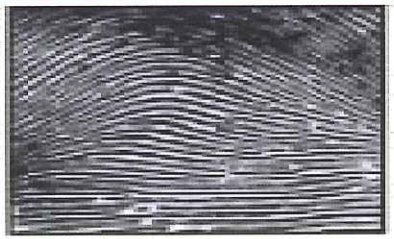
# Latent Prints

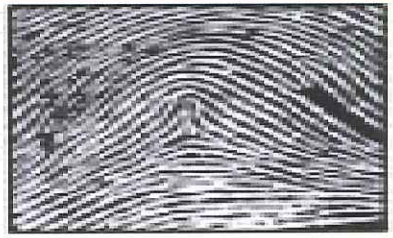


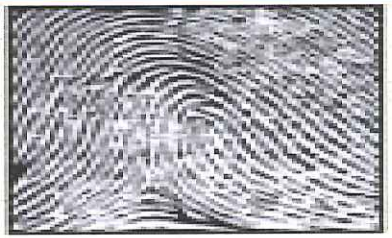


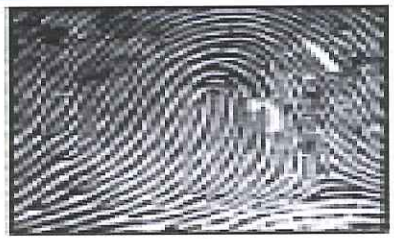
# Mistakes do happen

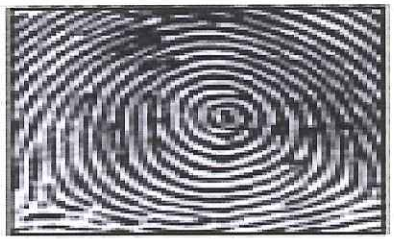
- As of April 1, 2010 252 wrongfully convicted have been exonerated by DNA testing to date
- No way to know how many may be wrongfully incarcerated because of a bad latent print identification

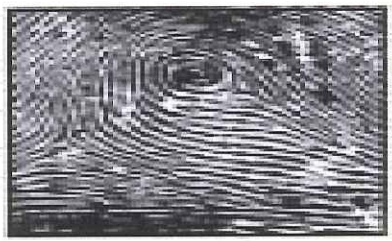

Plain Arch

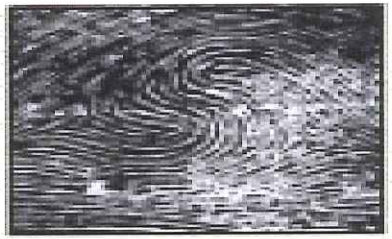

Tented Arch

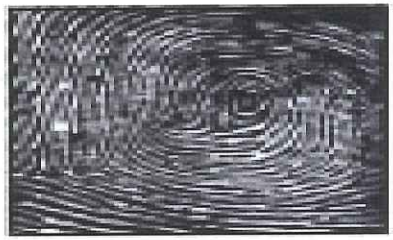

Ulnar Loop


Radial Loop


Plain Whorl

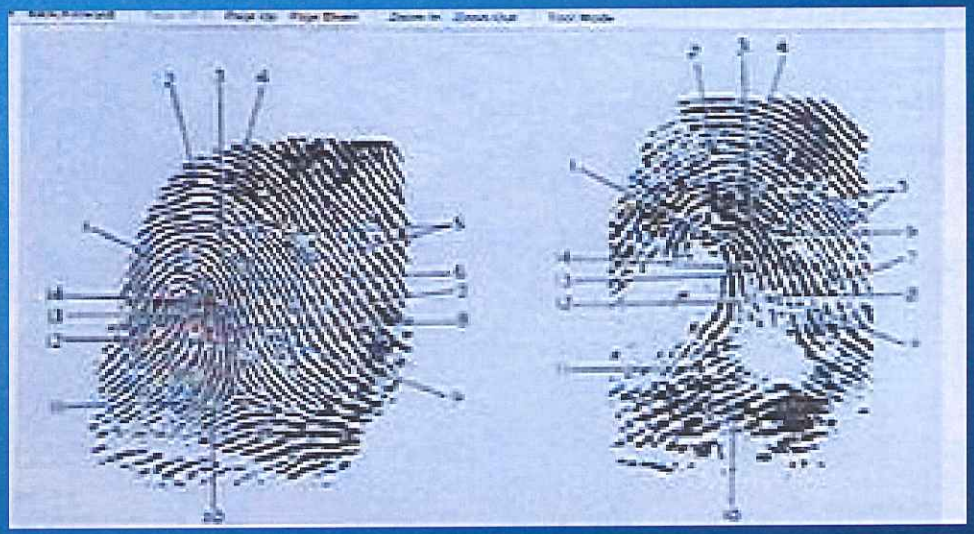

Central Pocket Loop


Double Loop Whorl


Accidental Whorl

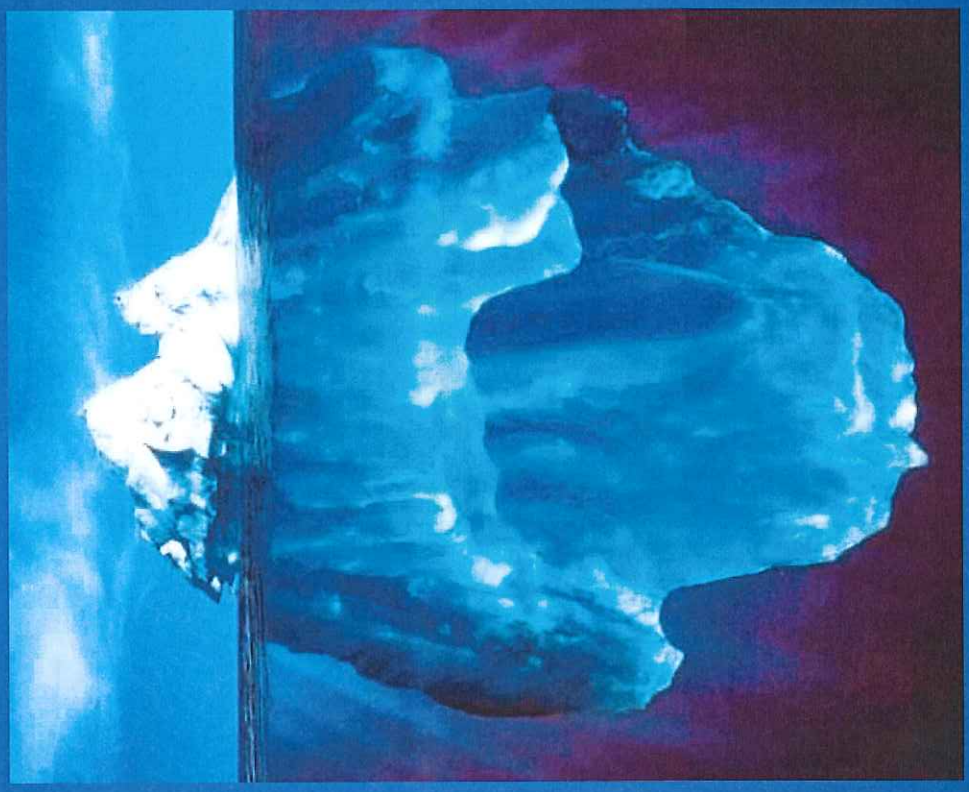
# Madrid Bombing 2004

- Brandon Mayfield



# Cowans

- Stephan Cowans – officer shooting in Boston 1997.
- Cowans was convicted on eyewitness evidence and a left thumb print with a 16 point match confirmed by 2 BPD examiners.
- DNA testing performed on several evidence items several years later exonerated him
- The fingerprint was reexamined and found not to match him



# Is there still a problem?

- Numerous challenges, to date, (almost) none have been granted
- Judge Gertner's ruling March, 2010 re expert testimony could be the tip of the iceberg
- The underlying question – does the current status of fingerprint examination research satisfy the legal admissibility standard? remains

# Byron Mitchell case

- *United States v. Mitchell, Cr. No. 96-407*
- First *Daubert* challenge
- 1999 Philadelphia
- Defense motion denied

# Editorial in Science

*"It's not that fingerprint analysis is unreliable. The problem, rather, is that its reliability is unverified either by statistical models of fingerprint variation or by consistent data on error rates."*

Dr. Don Kennedy

# Fingerprint Comparison

Based on assumptions of **uniqueness** and **permanence** of friction ridge patterns

- Underlying assumptions are not at issue
  - Judicial notice
  - Data from embryological development and statistical studies
- Comparison techniques used to make identifications are

# Lab vs. the courtroom

When techniques used in the lab are brought into the courtroom, must play by the rules of the court

For scientific or technical testimony, those rules include satisfying *Daubert* and reliability

# So Where's the Problem?

- Absolute Identification - when match is called the examiner is claiming that the latent print necessarily came from the individual in question to the exclusion of all other fingers in the world.
- "Zero error rate"
- No uniform standards for making comparisons and identifications
- Subjectivity aspect of identifications

# *Daubert* Factors

- Testing
- Error Rate
- Standards Controlling the Technique's Operation
- Peer Review
- General Acceptance

# Science vs. Law

- Science is an ongoing collaborative process
- Law seeks final resolution through the adversarial system
- Science seeks truth
- Law seeks justice
- Both will be served by conducting research on the ACE-V technique

# Science for Science's Sake

- Science teaches that you can't know the answers until you ask the questions.
- Science is a process or method by which factual statements or predictions are devised, tested, evaluated, revised, replaced, rejected or accepted.
- In light of a concrete case where we know something went wrong (Cowans), we must look into the what, why and how

# Who should be responsible for conducting the research?

- The greater the stakes in property, lives and liberty, the more incentive the system should have to ensure that only proven reliable methods are being testified to in court.
- Responsibility as scientists who testify in court to provide it.
- Responsibility of judges who admit the testimony to demand it.

*Daubert* and FRE 702 provide guidance for admissibility of expert evidence

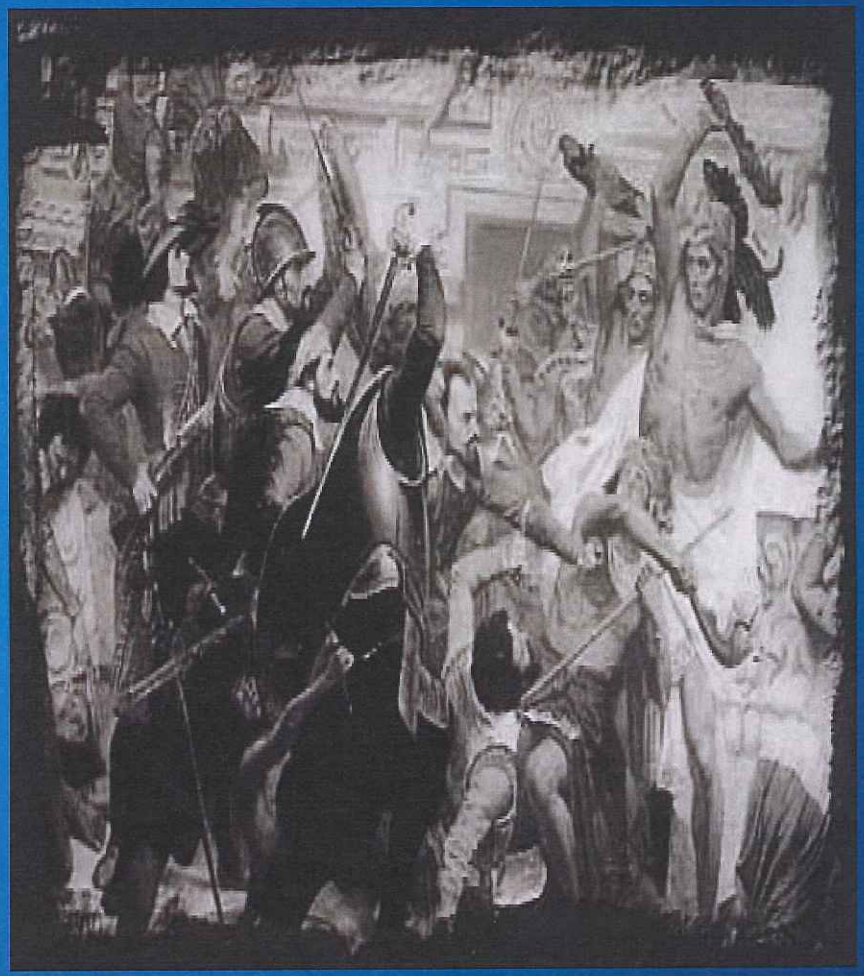
Courts can continue to say that fingerprint analysis is reliable, but that alone does not make it so. Only scientific testing will provide the empirical data to prove it.

# DNA Wars as a Model

- First use of DNA in criminal trials in late 1980's
- Technology was merely science used in research applied to human identification
- Didn't fully anticipate questions courts would ask
- NRC I&II
- Had to go back to the lab and do the research to provide the data courts demanded
- Perhaps a minor setback at the time but in the best interest of the discipline

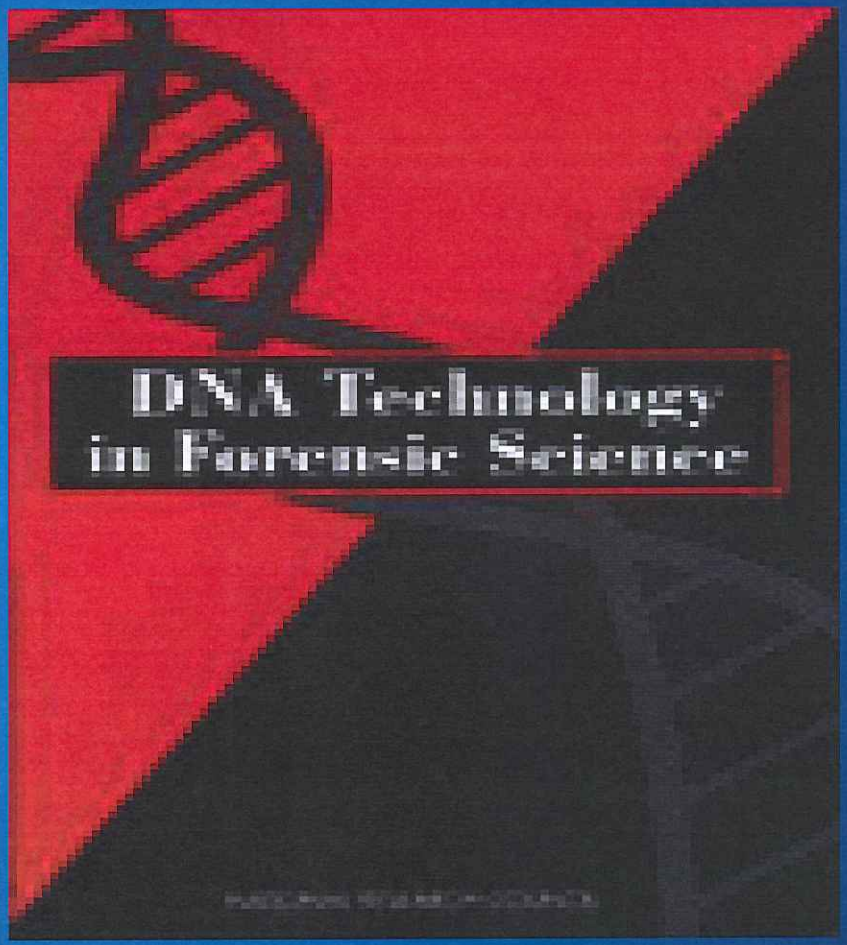
# The DNA Wars

Disagreement over the admissibility of statistical calculations assigned to the genetic profiles used for human identification provided valuable lessons for later forensic disciplines



# Interim Solution: NRC I

- National Advisory Group convened by National Academy of Science to draft recommendations on testing and reporting to the field
- Issued report in 1992



# Controversy over Statistics

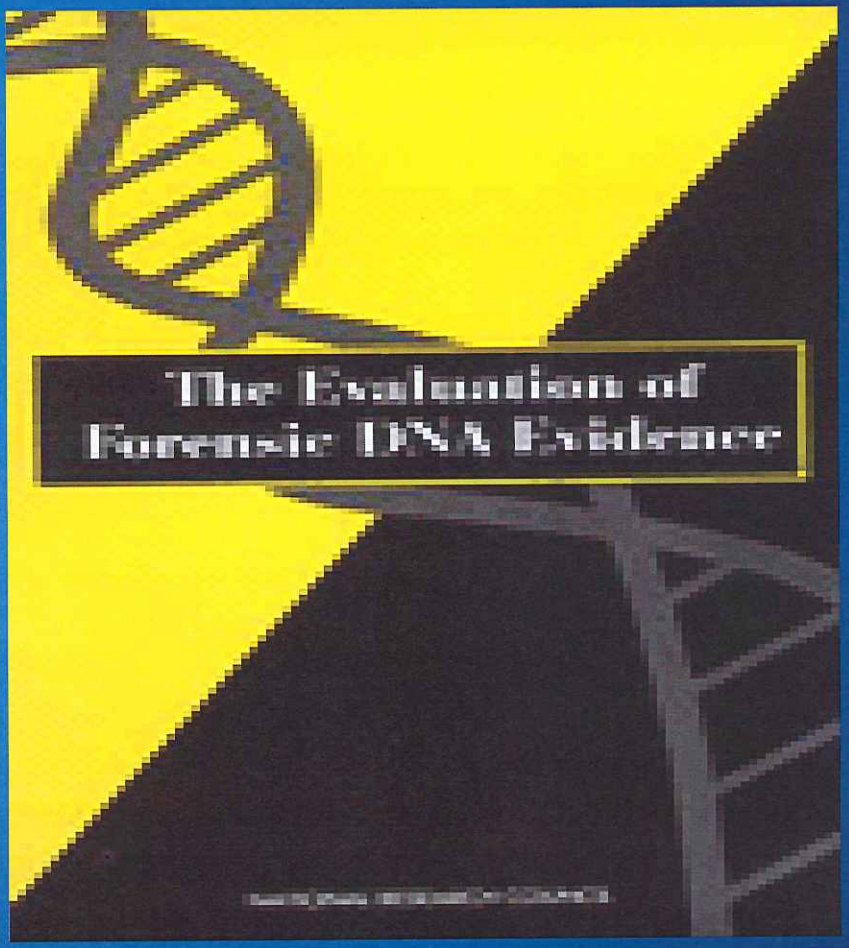
2 sides to the numbers:

- "big is big"
- calculation should be accurate/exact

Scientifically or statistically significant vs. legally significant

# Solution: NRC II

- Convened to resolve issues of statistical calculations
- Issued report in 1996 with amended recommendations on calculating statistics to account for potential subpopulation variations



# DNA laid the groundwork…

**DNA**

is grounded in basic principles of genetic inheritance; is reproducible, verifiable, and falsifiable

All disciplines should be subjected to this level of scrutiny, to rigorous and scientific validation

# NAS Report

- Did not say all forensic science is unreliable and should be tossed out; it identified weaknesses in some areas where insufficient research and validation of methodologies exist and recommended filling those gaps by conducting the additional foundational research

- Evidence can still be admitted, perhaps afforded less weight

# Statistics

- Stats are given with DNA results
- WHAT DO THEY MEAN?
  They give weight to the results but results can still have meaning in absence of stats

- Many forensic disciplines do not have stats, so scientists must be cautious not to OVERtestify to their conclusiveness

# Additional Considerations

# Authentication


How do you prove that the DNA detected and reported *actually* came from the event in question and was not planted, fabricated or misinterpreted by the analyst?

# Interpretation

- In addition to questionable statistics, results can be misrepresented in testimony
- Terminology matters ('consistent with', 'cannot be excluded' vs. 'identity', 'it's him')
  - May mean the same thing to a scientist, but not to a fact finder…

# Admissibility

Testimony can be wholly excluded if found to be overly prejudicial, or can be admitted with vigorous cross examination in hopes that the fact finder will afford it less weight.

How do we know we're getting our point across?

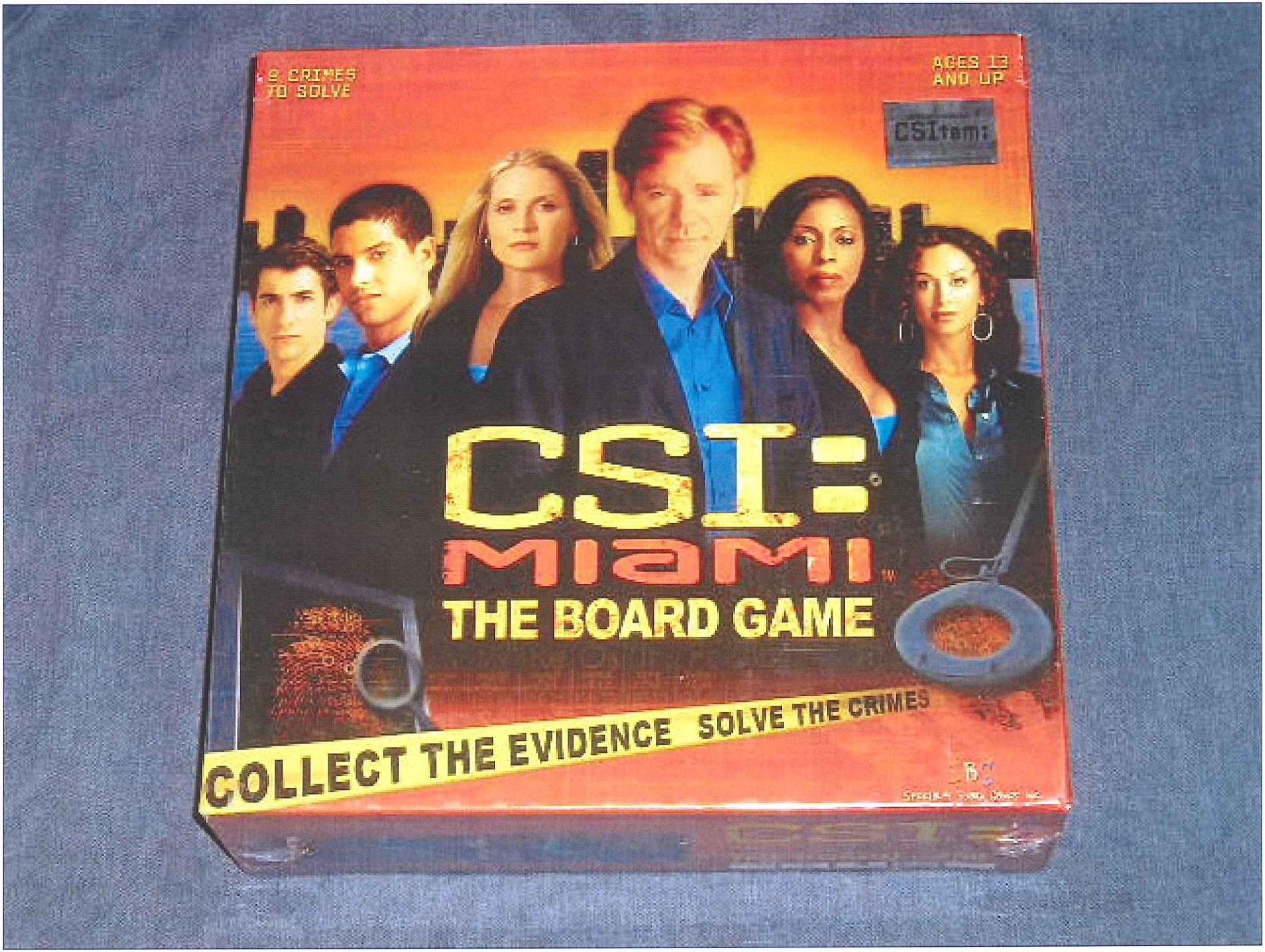
Verdicts

# Science vs. Junk

- Difficulties – opposing experts willing to take the opposite stance, confuse the issue
- With complex issues like DNA and digital evidence, how is a judge to know which to believe?

# Still not sure what to do?

- You can test your skills


8 CRIMES TO SOLVE
AGES 13 AND UP
CSI: MIAMI
THE BOARD GAME
COLLECT THE EVIDENCE
SOLVE THE CRIMES

**Anjali R. Swienton, MFS, JD**

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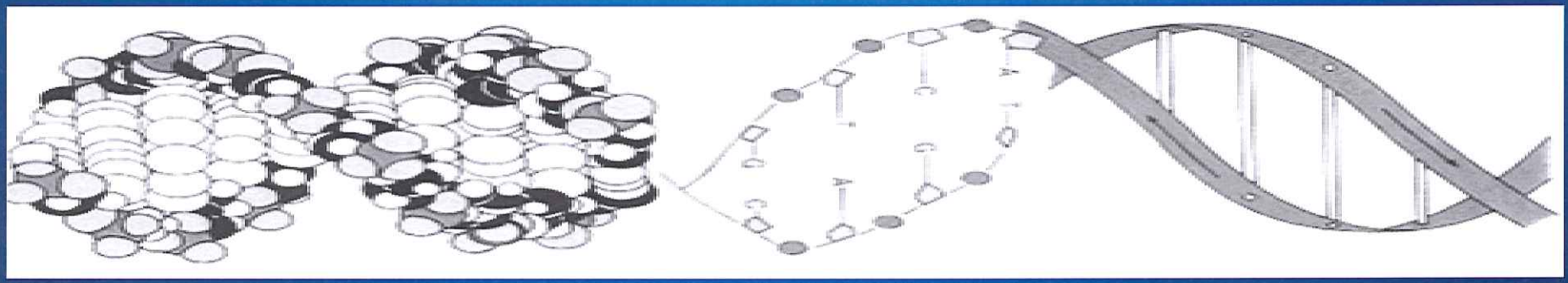


Attachment C

PowerPoint presentation slides
by Professor Jennifer Mnookin, J.D.

# The Courts, the NAS and the Future of Forensic Science

JENNIFER MNOOKIN, JD, PH.D.
PROFESSOR, UCLA SCHOOL OF LAW
MNOOKIN@LAW.UCLA.EDU

REVISITING OLD CONVICTIONS USING NEW TECHNOLOGY, AND NEW VIEWS OF OLD TECHNOLOGY

SIXTH CIRCUIT JUDICIAL CONFERENCE,

6 MAY, 2010

- What's the problem?
- First, and foremost:

INSUFFICIENT RESEARCH TO SUPPORT THE CLAIMS MADE

# Examples from Latent Fingerprint Evidence

- Individualization
  - What's the claim?
  - What's the support?
- No statistical foundation
- Probabilities – both unknown and not permitted
- Error rate unknown
- Proficiency tests inadequate
- No formalized metrics for determining quality, difficulty, or sufficiency
- ACE-V not really a "method"

- What's the bottom line? Is it unreliable?
- Honestly: we don't know enough to answer this question

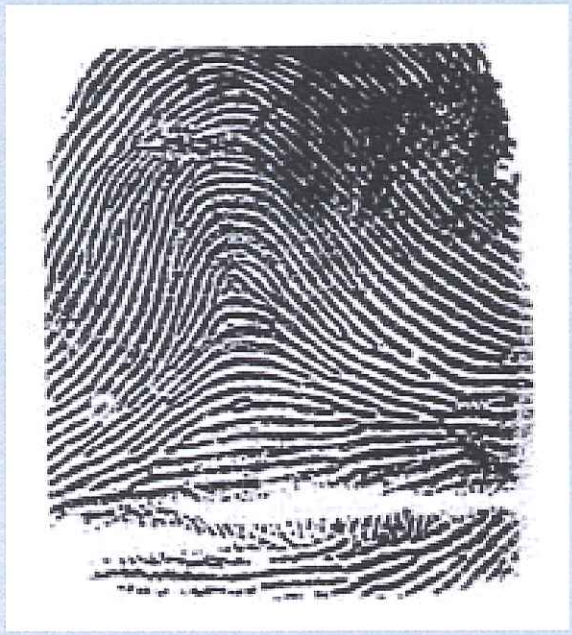
- 100 year natural experiment shows its power
- Clearly lots of variation in human friction ridge

- But: how often might different individuals have prints with a given quantum of similarity?
- ??????

# Brandon Mayfield Scandal

2004/24122 OUHNANE DAOUD

# The Fingerprints



Three fingerprints:

First: Ouhnane Daoud's exemplar
Second: Exemplar found on materials connected to the Madrid bombing
Third: Brandon Mayfield's exemplar

# All identifications are not equal

- AFIS issues
- How many prints?
- What is the quality of the images?
- Issues of contextual bias?

- But at present:
  - No formal difference in how AFIS cases are assessed
  - No formal quality metrics
  - No knowledge about how error rate varies as a function of print quality or comparison difficulty

# So what ought the courts to do?

# A Variety of Judicial Responses

- The Ostrich

- Daubert problem? What Daubert problem?

# Judicial ACE-V

- E.g., United States v. Havvard, 117 F. Supp. 2d 848 (S.D. Ind. 2000)
- "They have been tested in adversarial proceedings with the highest possible stakes -- liberty and sometimes life."
- "In sum, despite the absence of a single quantifiable standard for measuring the sufficiency of any latent print for purposes of identification, the court is satisfied that latent print identification easily satisfies the standards of reliability in *Daubert* and *Kumho Tire* . In fact, after going through this analysis, the court believes that latent print identification is the very archetype of reliable expert testimony under those standards"

# Dominant Judicial Response

- Legal ACE-V

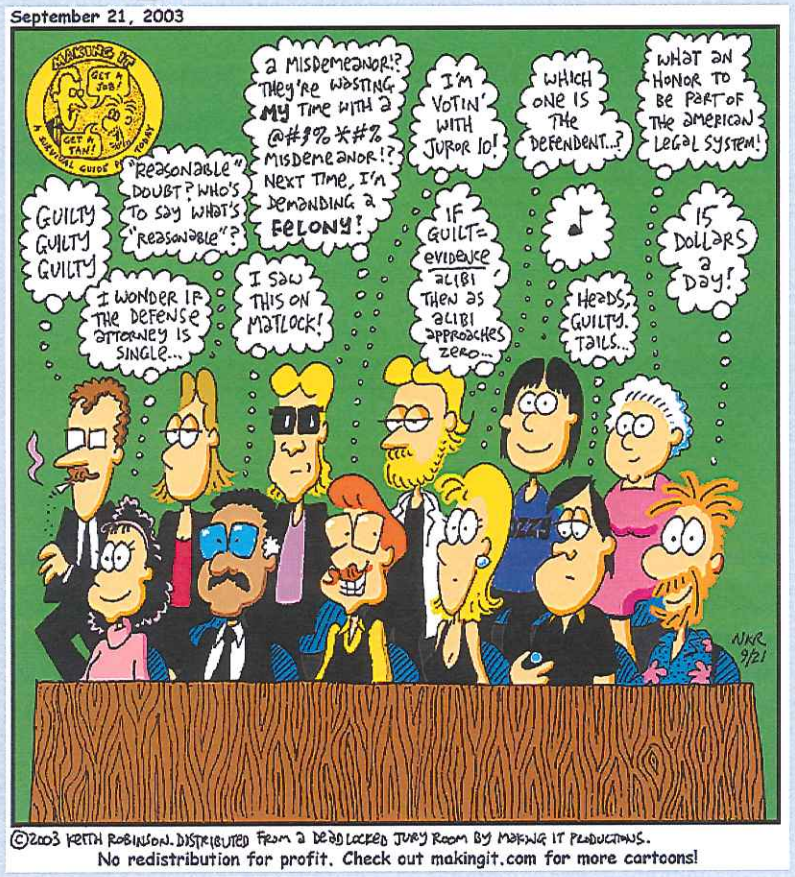
- Admissible
- Considering
- Everything
- it's Valid (enough)

# Judicial ACE-V

- With judicial ACE-V, the courts do recognize problems – e.g., insufficient testing, unknown error rate, no statistical foundation, subjective standards for determining a match
- But their basic conclusion: too bad we do not have better information, but what we have is good enough to warrant admissibility
- E.g., Llera Plaza II, 188 F. Supp. 2d 549 (E.D. Penn. 2002)); United States v. Sullivan, 246 F. Supp. 2d 700, 704 (E.D. Ky. 2003); United States v. Mitchell, 365 F.3d 215, 233, 250 (3d Cir. 2004);

# Most troubling response

- Excluding "field challenges" in the name of protecting the jury



# Examples

- E.g., Taylor (unpublished order) (Adina Schwartz);
  - "What the Court is confronting in the proffered testimony of Dr. Schwartz is not a difference of opinion, but a difference in kind of expert. . . . [T]o allow Dr. Schwartz to give this testimony during a trial would not be, as Defendant argues, to allow a healthy 'battle of the experts.' Instead it would be to engage in what this Court considers the highly questionable practice of allowing a second *Daubert* hearing to play out in front of the jury.
  - This second *Daubert* hearing "would not be very helpful to the jury" and "would likely confuse the jury."
- State v. Armstrong, 920 So. 2d 769 (2006) (Simon Cole)
  - Claim general critique of FP is irrelevant
  - "Hence, what Dr. Cole cannot do in challenging the *admissibility* of the State's fingerprint evidence, he equally cannot do here in purportedly challenging the *weight* of said evidence."
  - ???????

But what about. . .

"Vigorous cross examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence" (*Daubert*) ?

The best argument AGAINST inadmissibility is that understanding the weaknesses of this evidence is not beyond the ken of the jury. To admit 'shaky' forensic science evidence and exclude "field challenge" critiques of it is, in my view, deeply problematic.

# Better approaches

- Dividing the Baby

E.g., restricting ultimate conclusion. First published instance: United States v. Hines, 55 F. Supp. 2d 62 (D. Mass. 1999).

# Solomonic Compromise

- Superficially Attractive
- But conceptually incoherent . . .
  - What basis does the jury have for assessing the meaning of similarities and differences?
  - Rule 702 problem is eliminated, but this approach creates a serious Rule 403 problem. . .
- May still be an appropriate – hopefully temporary – compromise approach for a difficult Daubert question

- Is outright exclusion warranted?
- My answer:
  - Yes, sometimes . . .

- What should we require for admissibility?
- "Best evidence" approach to Daubert?
  - Excellent proficency tests that would provide useful information about error rates
  - No insurmountable obstacles. No reason not to do them.

- Key question: what evidence and forms of validation and testing actually supports the claims made by experts?

- Claims of individualization should not be permitted.
- Limits to knowledge should be acknowledged.
- Solomonic compromise and/or exclusion (until proficiency tests provide some degree of error rate information)
- Sufficiency jurisprudence should be revisited

## Thomas Bohan, Strengthening Forensic Science: A Way Station on the Journey to Justice, J. Forensic Sci., Jan. 2010

- Partial Buy-In from the Forensic Science Community leadership:

- In summary, what is needed immediately is a series of validation investigations. A validation investigation is a threshold study to determine whether a technique or theory the scientific validation of which has been questioned has in fact already been scientifically validated. This is a necessary first step in each instance, given that the practitioners of the respective techniques claim with some heat that their practices have already been validated. In order to secure their needed cooperation in studies aimed at finding the limits of reliability of these practices, a body with the recognition and respect of the National Academy of Sciences must first investigate whether the practice has already been validated, and, if so, what the limits of its validity are. . . .

- There will be three possible outcomes to the threshold studies. One, an unlikely one, will be that the practice in question has already been validated. The second, more likely one, is that it has not been validated, at least with regard to determining its range of validity. The third outcome would be, like that of the "bullet-tracing" method study, a finding that the theory or practice was invalid. A particularly important potential example of the latter is the so-called shaken baby syndrome theory. If the critics of this forensic theory are correct, there will be thousands of convictions and plea bargains to be re-examined. Yes, plea bargains, since most such bargains are entered into by defendants convinced that if they go to trial they will be convicted and sentenced to much longer terms than they can obtain through a deal with the prosecutor. It should be obvious to all that the forensic practices that have come under serious challenge should be subjected to these validation studies. Calling for them is not a defense scheme for getting criminals released or acquitted on a technicality. It is an effort to prevent persons from being wrongfully convicted, to release those who have been, and to redirect law enforcement resources to the apprehension of the actual criminals.